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GAS LIGHT JOURNAL

R.DOMANRKENNY.N.Y.

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Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

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[OFFICIAL NOTICE.]

Ohio Gas Light Association.

OFFICE OF SECRETARY,
COLUMBUS, O., February 22, 1890.

To Members of the Ohio Gas Light Association:

Gentlemen—As previously announced, the Sixth Annual Meeting of this Association will be held at Toledo, O., beginning at 10 A.M., March 19, 1890, and continuing two days. Boody House will be the headquarters of the meeting, the various sessions of which will be held in a very suitable room in the same hotel. Members and others desiring to attend are advised to write well in advance for rooms.

The following papers have been promised for the meeting:

1. "Theory and Practice in Gas Management," J. M. Bate, Supt. Gas and Coke Company, Canton, O.
2. "Municipal Control of Lighting," H. Wilkiemeyer, Supt. Gas Light and Coke Company, Portsmouth, O.
3. "Combination of Gas and Electric Lighting in a Small Town," George W. Bowers, Sec. Gas and Electric Light Company, Hillsboro, Ohio.
4. "Our New Coal Gas Works," G. A. Hyde, Engineer Gas Light and Coke Company, Cleveland, O.
5. "Advantages of a Combined Coal and Water Gas Plant," Geo. Light, Asst. Supt. Gas Light and Coke Company, Dayton, O.
6. "Another Year with Fuel Gas," Chas. H. Evans, Manager National Gas Company, Jackson, Mich.
7. "Ohio Street Lighting Statistics," W. C. Hedges, Secretary Gas Light Company, Mansfield, O.
8. "Graduated *versus* Uniform Rates," Chas. R. Faben, Jr., Supt. Gas Light and Coke Company, Toledo, O.

The following questions have been proposed for the "Question Box:"

1. At what point in the works is the best place for the exhauster?
2. In a lighting territory covered by illuminating gas and the incandescent electric light, which seems to be in the ascendency,?
3. Does a fine gas of 23 to 25-candle power help check the invasion of the incandescent electric light?
4. Should we not confine the work of our Association to the important interest it was established to promote, viz.: gas lighting and the manufacture of coal gas?
5. What system of electric lighting is best for adoption by gas companies?
6. Are cast iron pipes better and cheaper than wrought pipes for gas mains of 2 to 4 inches in diameter?
7. Does it pay to coat gas mains with coal tar?
8. What is the average life of a meter in constant use, with ordinary good care?
9. Is not illuminating gas of good candle power, sold at a reduced price for fuel, the true solution of the fuel gas problem?
10. Which is the correct method of tapping mains, on top or at the side?
11. Is the Welsbach burner with natural gas a success, and what proportion of the lighting does it do in towns having both natural and artificial gas?

Other interesting questions have been proposed, which will be presented at the meeting, and members are requested to come prepared to participate in the discussion of the above papers and questions.

Provision has been made for an exhibit, in connection with the meeting, of all kinds of gas appliances and apparatus, a large room on the ground floor, a few doors from the hotel, having been secured for this purpose. No charge for floor space will be made to exhibitors, and those desiring to avail themselves of this excellent opportunity of displaying their specialties will consign their goods and address their communications to Mr. Chas. R. Faben, Jr., Supt. Gas Light and Coke Company, Toledo, O., who has the matter in hand, and who will arrange the exhibit to the best advantage of all concerned.

In addition to this exhibit there will be other objects of much interest to our members and visitors, and the meeting promises to be in every way successful. It is hoped that every member will show his appreciation of what has been done, by being present; and gas companies not heretofore represented at our annual gatherings will be profited by sending a representative to this meeting.

A cordial invitation is constantly extended to all who may desire to become members of the Association, to do so, and the Secretary would be pleased to hear from any such persons.

IRVIN BUTTERWORTH, Sec'y.

BRIEFLY TOLD.

OPPOSITION AT ST. JOSEPH, MO.—For some time back our item columns have contained the various chapters of history that were made in connection with the attempts to establish an opposition gas company at St. Joseph, Mo., and we think that taken in its entirety the history is very amusing, in that it furnishes a record of duplicity, cunning, ignorance and rapacity. Some months ago one W. S. Crosby, of Chicago, at the instigation of certain parties who will not be named here, received a hint that St. Joseph, Mo., was a likely situation for an opposition gas company, and it cannot be gainsaid that the hint was a good one, for the old St. Joseph Gas and Manufacturing Company had always been a steady dividend payer. In fact the only circumstance that could cloud the brightness of the schemer's chances was the possibility that the local authorities, remembering the liberality with which the city and citizens had been treated by the old Company, would refuse to assent to a plan that must necessarily depreciate its property. However, Crosby and his backers made application for a charter to the Council, the provisions of which have already appeared in the JOURNAL—in fact their precise nature is not of great moment, since they were founded on the skeleton plan that serves as the basis for all documents of a like nature. In due time, and upon "mature thought," the Council laid the application on the "suspense hook," which was supposed to end the matter. In passing it might be remarked that such a course was adopted chiefly on the ground that the old Company should be protected, because of its good record, and because it was managed by home capitalists. This last argument seems to have shown to certain local parties a way of whipping in on their own account, and in due course of time one McGuire appeared before the Council in the guise of a home rule advocate for an opposition charter. If we mistake not, still another of the same stripe petitioned for like recognition. The newcomers seem to have been able to "convince" the Council that their prayer should be answered. In any event they have carried the day, and whether it is McGuire or Allerton—or whether there is any real difference in their interests or not we cannot say—the franchise has been granted as per the conditions printed on pages 328 and 329 of our last issue. It would seem as if Crosby ought to feel rather sad about this time—unless, indeed, he is a friend of "McGuire's." This does not seem altogether improbable, especially when one remembers that the charter awarded is much more favorable in its provisions than that asked for by Crosby. In fact, under the new charter the proprietors cannot fail to make a good thing out of it, should they ever be able to induce Mr. Turner and his fellows of the old St. Joseph Company that it would be worth their while to buy it. In connection with this we herewith publish the following letter from Mr. J. H. Farrish, Secretary of the St. Joseph Gas and Manufacturing Company, which requires no particular comment, save in respect to his implied doubt as to whether we "find subscribers in the far East interested in the misfortunes of a Western Company." To that we can only reply—and in such reply feel that we are right—there is no sectionalism in the gas business, for what affects one affects all, hence all are interested. Mr. Farrish writes: "To the Editor AMERICAN GAS LIGHT JOURNAL: Inclosed find clippings which tell the tale. The original projector of the Jackson fuel gas scheme for St. Joseph—Mr. W. S. Crosby—got left, a franchise having been granted to a St. Joseph syndicate. Our Common Council, for reasons best known to themselves, have concluded that it is best for the city to have two gas companies hereafter. The new franchise does not limit the new Company to any kind of gas or known process of manufacture; we do not, therefore, know what to expect. We shall keep you posted from time to time, provided you find subscribers in the far East interested in the misfortunes of a Western Company.

"Very truly yours, J. H. FARRISH."

"Since the above was written the bill has been vetoed by the Mayor, and passed over his veto. It is now a law.—J. H. F."

WHAT ADVERTISERS SAY.—We are not given greatly to the practice of telling how we are regarded by our advertisers and subscribers in the matter of the wares of the former and the needs of the latter, in so far as each may be served in those respects by an appeal to our columns. In this instance, however, we will transgress the rule by the submission of the following letter, which goes to show plainly the value of advertising in a technical paper, which has neither friends to protect nor enemies to punish. In other words, a paper that seeks to serve honestly the people who support it.

"H. W. Rappleye, Constant Volume Gas Burner,
"Office, 1345 Arch St., Philadelphia, March 12, 1890.

"Messrs. A. M. Callender & Co., 42 Pine street, N. Y.—Gentlemen: Herewith I hand you my check to your order for $— — (amount of inclosed bill), which please receipt and return. I also inclose additional 'ad.,' which you will please insert in next issue. Somehow (unexplainable to me) the JOURNAL reaches a line of trade which I have heretofore been unable to secure. Yours very truly, H. W. RAPPLEYE."

Results from the Van Steenbergh Water Gas Apparatus.

The Van Steenbergh process of gas manufacture, which in its American type is well and not most favorably known to our engineers, is being illustrated in a practical way in England, at Humphrey's Hall, Knightsbridge, the trial run having been committed to the care of Prof. Vivian B. Lewes. This gentleman has compiled the following figures, which explain themselves:

TABLE I.—*Giving Full Details of the Make of Carbureted Water Gas by Van Steenbergh's Plant (Feb. 11, 1890).*

Quantity of gas made	8,400 cubic feet.
Time occupied—	
In blowing	58 minutes.
In gas making	48 "
Fuel consumed—	
Anthracite	205 lbs.
Naphtha (70° Beaume)	23 galls. 6 pts.
Illuminating power of gas made (corrected)	20.5 candles.

Analysis of Gas.

	Unpurified. Per Cent.	Purified. Per Cent.
Hydrogen	—	40.33
Marsh gas	—	17.08
Illuminants	—	7.59
Carbonic oxide	—	25.00
Carbonic acid	2.15	0.50
Oxygen	—	0.17
Nitrogen	—	9.33
Sulphureted hydrogen	2.84	nil
		100.00

Total sulphur (by Letheby test)	6.67 grains per 100 c. ft.
Sulphureted hydrogen in unpurified gas	23.80 " "
Sulphureted hydrogen in purified gas	nil
Ammonia	nil
Bisulphide of carbon	nil

Consumption of Materials per 1,000 Cubic Feet of Gas Made.

Naphtha	2 galls. 6½ pts.
Anthracite	24½ lbs.

TABLE II.—*Showing the Composition and Illuminating Power of the Gas Made by the Van Steenbergh Plant from Various Carbonaceous Fuels with 76° Naphtha.*

	Foundry Coke.	Gas Coke. Unpurified.	Gas Coke. Purified.	Anthracite. Unpurified.	Anthracite. Purif'd.
Hydrogen	33.44	—	39.05	—	38.44
Marsh gas	23.38	—	26.71	—	19.30
Illuminants	11.14	—	9.27	—	7.49
Carbon monoxide	19.00	—	13.50	—	23.81
Carbon dioxide	2.24	6.01	1.02	2.16	0.42
Nitrogen	9.50	—	9.72	—	9.69
Oxygen	1.30	—	0.73	—	0.85
Sulphureted hydrogen	nil	0.35	nil	trace	nil
	Candles.		Candles.		Candles.
Illuminating power (corrected)	22.4	—	22.9	—	21.8

NOTE.—The low carbonic oxide in the make from gas coke is due to the fuel never being so hot as with anthracite; and the result is an increase in the percentage of carbonic acid in the unpurified gas.

OFFICIAL REPORT.—REVISED BY THE SECRETARY.—CONTINUED FROM PAGE 326.]

TWENTIETH ANNUAL MEETING, NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

HELD AT YOUNG'S HOTEL, BOSTON, MASS., FEB. 19 and 20, 1890.

SECOND DAY—FEB. 20—MORNING SESSION.

The Association met, pursuant to adjournment.

The President—The representatives of the Boston Gas Company are asking whether the Association will accept the invitation to visit the works to-day, and I have given them to understand that on account of the storm we cannot probably visit them. It may not be necessary to put the matter to a vote, but at the same time if I am wrong I would like to be made right. I told them, knowing the grounds down there to be very bleak, that I did not think it would be prudent for us to visit them, although we are very sorry to give it up. [It was therefore informally agreed on, for the reasons stated by the President, that the Association would not make the visit.]

IN THE MATTER OF BADGES.

Mr. Stiness—For the Committee on Badges I desire to report that the committee had an informal meeting yesterday, and that they recommend a gold badge, similar in appearance to the monogram on the programme of this meeting, the badge to be made either in the form of a button or as a pin with a patent fastener. The cost will be about $3. It was also the opinion of the committee that the badges should be paid for by the members purchasing them, and not out of the funds of the Association. I did intend to introduce a resolution—if you will pardon me I will state it now—to the effect that the committee be continued, and that the Secretary be requested to obtain the names of those who will take a badge. Personally I make a very decided protest against appropriating the small amount we have in our treasury for the payment of badges.

The President—I think we will defer further business on this subject, and listen to the paper, by Mr. Ralph Woodward, of Waltham, Mass., entitled—

SOME NOTES TAKEN IN A SMALL GAS WORKS.

The subject of the management of small gas works has been so often written on, and in this Association so fully treated, that I feel I can add but little to the volume of experience that has already been handed in; but, owing to the persistency of our Secretary, I stand before you. My paper will be nothing more than its title suggests—some notes jotted down from time to time.

Most of us have some "hobby" we are particularly fond of riding. To many it is purification, others enrichers, and others leakage and condensation. There is hardly any subject more profitable in discussion than this last—leakage and condensation.

In this State alone, last year we had as "gas unaccounted for," 267,865,892 cubic feet, or 0.083 per cent., and the weather has been particularly favorable to a small leakage. We have all worked on this question and much has been done; but our work is only relatively satisfactory. Large leaks generally make themselves known by their very offensiveness, and are easily remedied, but small ones are sometimes very troublesome to locate. Probably our greatest loss from leakage comes from this latter cause.

To how small a percentage is it possible to reduce leakage? It depends on many conditions—age of mains, kind of joints used, depth of main, etc. With a good system of valves and with appliances for frequent testing and systematic work, much can be accomplished. As has been said, small leaks give us our greatest annoyance. I have in mind one street, not over a half mile in length, that, after the winter of 1887–8, when tested with prover, showed a leakage of 25 cubic feet an hour—219,000 cubic feet per year. After careful examination and repair we had been unable to find a leak that would amount to more than one cubic foot an hour, but had found a plenty of small ones, you may be sure.

In the system under my care we have nearly 17 miles of mains, and it is mostly small pipe, which, as you will agree, is more susceptible to leakage than larger pipe; and on this system we have 112 street valves, so arranged that any section between them can be separately tested.

The average distance between our valves is 800 feet, and while in old systems it may not be expedient, yet, in laying out new work, valves should be put in about 500 feet apart, and always at street intersections. We use "long-end" valves with a ¾-inch pipe running to either side, and a 10-light test meter, with index on top, to read amount passed an hour by observations of one minute, and keep a careful record from year to year of the leakage of each street.

With such a system, and a thorough knowledge of the probable day consumption of the district under test, leaks can be located with great precision. Our loss last year was 55,435 cubic feet per mile of main; small, compared with many works, but enough to demand an inquiry how it can be still further reduced.

How much do we lose by actual leakage? How much by defective meters? And how much by condensation?—by which we mean shrinkage or loss from difference in temperature. It has been stated that our loss from shrinkage in this region will average 2½ to 3 per cent. If we can count on this loss for a surety, the remainder of our loss by "gas unaccounted for" will, in many cases, be but a small factor. Our gas is measured at the works at an average temperature of, say, 60° F. I question if the average temperature of house cellars is far below this.

Too little stress has been laid on the regular testing of meters, which are tested at intervals, but usually at intervals too far apart. From all meters tested by me last year we have the following results:

Correct or within 2 per cent. limit	159
Slow, average 6.6 per cent	82
Fast, average 4.9 per cent	21
Failed to register	4
Total	266

Average, 1.68 per cent. slow.

Our practice is to give every new consumer or tenant a new meter, or one known to be correct; thus my list includes all meters brought in, whether they have been in use six months or six years. We can safely count on an average of 2 per cent. loss, in our Company, from slow meters where they have been in constant use over five years.

Our Company has suffered, to a great extent, from the effect of having a system of drains and sewers laid through our city. Our mains have been broken, long stretches of mains have had to be removed and again relaid, and sewers crossing these new trenches break from unequal settling. I mention this only as an instance of the loss and annoyance we are subjected to, and few of us have any redress.

Some companies run a main for gas under each sidewalk. This surely would solve this difficulty.

Our Company has made a creditable record in its sale of gas stoves, but nothing that can be called satisfactory. We put our stoves on a month's trial, and, if then wanted, sell at bare cost, fitted up. Two difficulties in extending the introduction of stoves, that lie in the stoves themselves, are: They cost too much for the amount of work that can be done; and many of them give a disagreeable odor when burning.

In a series of tests made with Lungren lamps under different pressures, and adjusting the flame to burn at its minimum and keep lighted, we found, with the pressure we carry, that a 12-foot lamp could not be kept burning safely with less than 1 cubic foot an hour. Customers objected to this extra amount in their bills, so we had to set our lamps to shut off entirely during the day. I might say that our lamps were easier to keep in good repair when kept lighted.

The disposition of residuals is always a good theme for discussion. The electric light, for many of us, has helped solve the coke question, and if good sales can be made outside, tar can be used for fuel with good results.

We find 82 gallons of tar equal to 1 chaldron of coke, and with us it is economical to use. The advantages with tar are: First, high flame temperature; second, more perfect combination of combustion; third, ease of regulation; fourth, no clinkering and consequent loss of heat.

The Company with which I am connected supplies a manufacturing city whose mechanics are mostly of the best class. They earn good wages, own their own houses, to a large extent, live very comfortably and enjoy many luxuries; yet, comparatively speaking, few use gas either for lighting or cooking. Their houses are always piped for gas, our mains run by their doors, and they surely can afford, at present prices, to use gas; and should we once get them on our system as customers they would not leave us.

What hinders them? An impression I think prevails generally that it is expensive to introduce gas—that is, for running services and setting meters. Our practice is now to carry our pipes to the street line of an abutter, and he to pay all other expenses beyond; but it was not many years ago when a would-be consumer had to help pay for the pipe in the street.

Last year our average charge to abutters was $2.88 for service and $2.40 for setting meter, and we make both inlet and outlet connections to meter and pipe back to the "riser." These are surely not extrava-

gant rates; but could we not afford to still further lessen these petty charges?

Our business is to sell gas, and not a stone should be left unturned to help introduce its proper and economic use. How many thousand old iron burners and narrow-necked globes are in use to-day?

The electric light has only proved a blessing in disguise, but kerosene oil is, and has always been, our strongest competitor.

Discussion.

The President—Do any of you wish to question Mr. Woodward with regard to his paper? It is the general impression of gas men that meters, after 5 years' use, lose 2 per cent. Has any one any figures to state as to the amount of loss?

Mr. Stiness—I suppose there is a liability, after 5 years of continuous use, to lose a little; but I believe the practice in most companies now is not to leave them in for that length of time without a thorough test, and making repairs if needed. Mr. Woodward states that he charges for services and setting meters. That is one item which in my opinion should be stricken from the charges of every gas company. I do not charge for services; and if a street is to be opened we cover it as soon as possible with a gas main. I believed a good many years ago that it was poor policy for a gas company to make a man mortgage his house for the sake of lighting; and we have acted on this idea in doing away with all charges of this kind. I believe it would be to the interest of all gas companies to discourage all charges of this kind. I know it is the policy with many companies in Rhode Island and Massachusetts to seek the consumer, and not to compel the consumer to seek the gas company. In our company we do not allow the meters to run for 5 years without testing them. We make a thorough test, and we know that the meter is right when it is put in again.

Mr. Sherman—Are your joints made of cement, or of lead?

Mr. Woodward—All cement joints.

Mr. Sherman—If made of lead I think you would have a much larger leakage. My experience with lead joints is that they require a great deal of attention.

Mr. Woodward—We have no lead joints, except those which cross the bridges in the city; and those have to be relaid very often.

Mr. Allyn—In Cambridge the practice has been similar to that mentioned by Mr. Woodward. We charge the consumer, as near as we can get at it, the actual cost of the service inside the street line, and the cost of connecting meters. When I went to Cambridge the practice prevailed there (I think it still prevails in Boston) that when a consumer applied to have gas introduced into his house, a meter was sent him, and he obtained the gas fitter to make the necessary connections. We found so many places where improper connections had been made, that we stopped that plan, and the company now connects all its meters. There is no doubt but that the plan of changing meters at stated times is a good one, but in attempting it we have met with a good deal of opposition from consumers, who seem to think as soon as we send to a house to take the meter out, we do so because they believe the company is not getting royalty enough for the use of the meter, and will put in one that will work a little faster. I have no figures with me to show the average variations of meters taken out; but we had two extreme cases this winter. One meter had been in constant use in a house for 25 years, and the other for 30 years. On being tested they were both found to be within 1 per cent. of correct.

Mr. Humphreys—Will Mr. Woodward state what day pressure he carries? He speaks of it being necessary to adjust the Lungren lamps to use a foot in the bye-pass.

Mr. Woodward—Perhaps our pressure is a little different from that of other works, but we have to carry almost as much day pressure as we do night pressure, on account of supplying large factories. From the time they extinguish lights at night, until 6 o'clock in the morning, we run on low pressure; but on account of these variations we found that we could not get along with less than 1 foot per hour, on an average, in the Lungren lamps, when turned down low.

Mr. Sherman—Did I understand you to say that the average temperature at which you register your gas is 60° F.?

Mr. Woodward—That is average temperature at the station meter for the year.

Mr. Sherman—What is it in the summer?

Mr. Woodward—The temperature given is the average of the year.

Mr. Sherman—I do not think you credit your loss account with enough for condensation. I think most of us register our gas at very much above 60°, on the average, and we do not credit the loss account with the loss which comes from condensation. When the account is made up it is all charged to leakage account, when in most cases 2 per cent. of it, and sometimes more, should be attributed to the difference between the temperature at the station meter and that at the consumer's meter.

Mr. Woodward—Our leakage for the last year was 3½ per cent., so that we have not a very large margin to charge off to the difference in temperature.

Mr. Addicks—How do you test the meters?

Mr. Woodward—We test them all in the shop. We go to a house, put in a new meter, bring the old one to the shop, let it stand over night near the prover, and test it in the morning.

Mr. Addicks—The Boston Gas Light Company has sometimes, after testing a meter in the house of the consumer, brought it to the shop and re-tested it, and a difference between the two tests of 4 or 5 per cent. has been found. In some cases where the consumer claimed that the meter was wrong, and asked for a test, we have tested it in the shop and found it correct.

Mr. Sherman—I would like to ask Mr. Woodward how much gas he sells per ton of coal. His leakage is remarkably low. Does he know what the average is?

Mr. Woodward—I cannot state that; but the average yield last year was about 5.2 feet.

Mr. Sherman—In the reports of the Commissioners is there a record of any lower leakage than yours?

Mr. Woodward—I have not seen any; but I judge there will be some small accounts of leakage, because the State Commissioners reported that the average leakage had dropped from 13 per cent. last year to 8 per cent. this year. There is a very great difference.

Mr. Sherman—What is the proportion of your street light consumption to the other consumption?

Mr. Woodward—I have not figured it in that way. We keep the numbers of hours that we burn the street lights.

Mr. Sherman—How many street lights have you?

Mr. Woodward—We have 186 street lights.

Mr. Coggshall—Does the yield of 5.2 include the enricher?

Mr. Woodward—That includes the enricher. Last year we used gas oil as an enricher. We did not use any during the summer, but when we were using it we never ran over 2½ gallons per ton of coal.

On motion of Mr. Allyn a vote of thanks was tendered to Mr. Woodward.

Mr. W. R. Addicks, of Boston, Mass., here read the following paper, on the—

VAPORIZATION AND FEED OF OIL TO GENERATOR AND RETORT.

If what follows serves to bring out future united investigation and discussion of this subject, it will be all that I desire. I wish to treat it at the present writing from a practical standpoint only.

I consider oil the most important factor in a water gas works, and in a coal gas works nearly as much so. In a water gas apparatus bad handling of this product will produce lampblack or tar—the tar well nuisance and fouling of scrubbers, condensation in large quantities in purifying box bottoms and drips, and even both of these substances in the very burners. The same material badly handled in a coal gas retort will produce similar troubles, though possibly to a much less extent.

In addition to the troubles hinted at above, which make life a burden to the gas superintendent and the telephone—an invention of Bell indeed—with oil at 3 to 6 cents per gallon, it increases most seriously the cost of gas in the holders, works' repairs, and the distribution department. I have endeavored to name the important points; your own experience, especially if you have gone through the experimental stage—but even after that stage—will make each of you think of many other points.

I divide my subject under the following heads, which state the principal features to be thought of in the vaporization and feed of oil to gas generator and retort:

A. Oil should be fed under constant pressure.

B. The quantity being fed should be ascertainable at any time.

C. (1st) Any treatment oil receives must be gradual in its changes. It must never be shocked. (2d) After being once brought to a given temperature, this must never be lowered until the oil has become a fixed gas at normal temperatures and pressures.

D. It should be fed to the apparatus at a pressure only just sufficient to permit the oil to enter in sufficient quantities.

E. The quantity fed to a generator (and the same is true of a given number of retorts) should be a constant proportion to the number of thousands of feet of gas being manufactured at the time.

In considering these heads, I will repeat them as separate texts.

A. *Oil should be fed under constant pressure.* When elevated supply tanks are in use, the best automatic device I know of—and I believe everything should be made automatic when possible—is that devised by Mr. Jos. Flannery, at the 132d street station of the Standard Gas Light Company, in New York city.

Fig. 1 illustrates roughly the principle of this, and a possible construction of it.

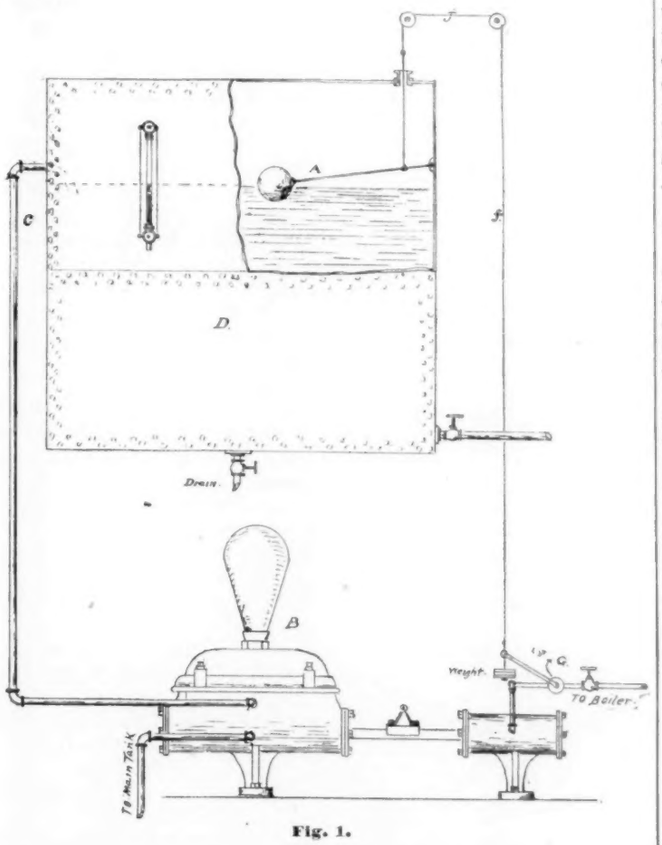

Fig. 1.

The ball and cock *A* rises and falls as the oil is fed, by pump *B*, through inlet *C* and to tank *D*, and drawn off through the outlet *E*. The rising or falling of ball and cock *A* cuts off or admits steam to steam cylinder of pump *B*, by means of cord *f* and valve *G*, preferably of Huntoon regulator pattern. The apparatus is complete of itself.

Where elevated tanks are not desired, either from questions of expense of elevators or from regulations of Fire Commissioners, a system devised by the writer can be used. This is not, as used to-day, as absolutely constant as the method above, but it can be made so; and where a new apparatus is made, with duplicate pump and tank, etc., in proportion to quantity of oil desired, it will be so.

In Fig. 2 pump *A* draws oil from main tank *B*, through suction *C*, delivers through supply *D*, upon which is an "Ashton Relief" *E*, discharging back into main tank *B*. Pressure governing tank has compressed air *F*, oil under pressure *G*, and water *H*. Pressure is indicated by gauge *J*, and height of oil, which is variable, by glass gauge *K*, and height of water, which should be constant, by glass gauge *L*. Brass pipe *M*, connecting with regulator *N*, which feeds steam to steam cylinder on pump *A*, regulates the pressure on the pressure tank *G*, the regulator being the principal feature. *O* is the draw-off pipe to free the top of the water from dirt, *P* a drain pipe, and *R* the outlet of tank leading to oil meter, hence to vaporizer, and, last, to the gas machine.

It is intended that the pump and pressure tank shall be placed wherever the storage tanks are located. The pipe leading to the generator house should be of small size, as under pressure it is not required of large size. The whole apparatus is entirely automatic. Excess of pressure takes care of itself; want of pressure would soon be known in the generator house. We have thus obtained the fulfillment of the demands of constant pressure.

B. *The quantity being fed should be ascertainable at any time.* The sight-feeds are probably old friends to all, and there is no necessity of going into any details as to them. Suffice to say they are poor guessers; or, rather, they permit a gas maker who is a good guesser to make a poor guess as to what he is doing.

I use at the Bay State works an oil meter marked in gallons, having one dial marked one gallon to one revolution of the hand. This, therefore, indicates quarter gallons, and, by estimation, any proportional part desired. This gives an easy reading for the gas maker.

I am sure everyone who has had experience with oil meters will at once say they are not accurate. Well, this is true of the meters in use thus far. I am hoping that the "Hersey," the one I am at present trying, may prove accurate. But even with their inaccuracy they are indispensible, in my opinion. The gas maker can come very closely, indeed, to the exact number of gallons he is feeding per minute. The make of his machine he knows, and so he can run the number of gallons per thousand he is ordered to, or follow out orders for so many gallons at end of each coaling, if he cannot be trusted to use his judgment to the former extent.

So we have now obtained the second condition within reasonable practical accuracy.

C.—(1st.) *Any treatment oil receives must be gradual. It must never be shocked.* Remarks: This will readily be permitted to stand as an axiom, I think; it is evident if oil is thrown cold into a hot apparatus a large quantity of lampblack will at once be formed, followed by a still larger quantity of tar, and some oil in the condition desired for carbureting or enriching.

(2d.) *After being brought to a given temperature this must never be lowered until the oil has become a fixed gas at normal temperatures and pressures.* Remarks: This likewise is an axiom, for would it not be a waste of heat to permit a partially vaporized oil to be cooled in any way?

D.—*It should be fed to the apparatus at a pressure only just sufficient to permit the oil to enter in sufficient quantities.* Remarks: I state this as I have seen oil fed to an apparatus under very high pressure through a (comparatively) minute opening in a spray.

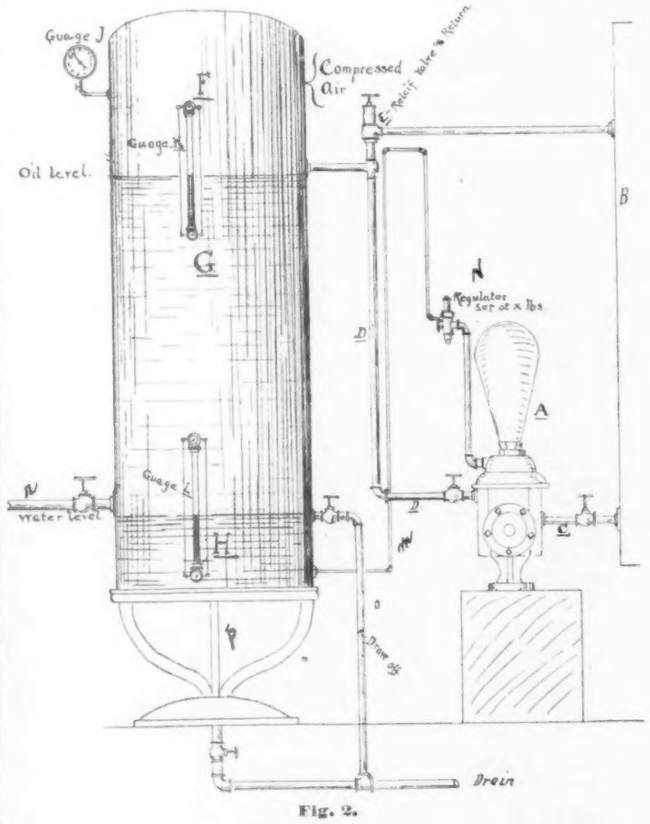

Fig. 2.

You all know that any liquid released under pressure, in expanding to the volume which it must occupy at the pressure and temperature of its released condition, must absorb heat; consequently, in this apparatus the designer called upon the heated chamber to furnish still more heat when the chamber was already overtaxed in this respect. This machine I refer to was popularly known as the "tar machine," which, I think, illustrates my point effectively. It is for this reason I make the condition "D" a vital one. It could be done successfully by

providing considerable preheating; but I consider it bad practice. I have endeavored to obtain the results demanded by the condition, "C," (1st and 2d) and "D" in a partial way only, by means of a vaporizer, though I believe that heat imparted to the oil, such as waste heat, after the products of combustion leave the superheating chamber, is desirable, though not vital, and I believe it is not for this reason.

Granting that oil at 32.5° F. is a vapor, then the quantity of heat necessary to take it 500° higher is comparatively small. I will try to illustrate by arguing from the known to (at least to me) the unknown.

A—Heat units raise 1 lb. water, 32°, to water 212° at pressure 14.7 lbs.	180.52
B—Heat units raise 1 lb. water, 212°, 14.7 lbs. to steam, 14.7 lbs. and 212° F.	966.08*
C—Heat units raise 1 lb. steam, 212°, 14.7 lbs., to steam 300 lbs. and 417° F.	62.56
D—Heat units to raise 1 lb. water, 32° F., 14.7 lbs., to steam, 300 lbs., 417° F.	1,209.16

A is 14.9 per cent. of D.
B is 80.0 per cent. of D.
C is 5.1 per cent. of D.
A + B is 94.9 per cent. of D. (A + B is the condition we are seeking.)

NOTE.—Total heat, steam, 212° F., and 14.7 lbs., is 1146.6, with volume 1644. Total heat, steam, 417° F., and 300 lbs., is 1209.2, with volume, 97.

Granting that oil, being a fluid, follows the same law as water, if we bring oil to a vapor we have attained the result of greatest moment. I have obtained this by means of steam-jacketing the oil pipe from the oil meter to the entrance to the heating chamber. The details of construction are indicated in Fig. 3.

In Fig. 3, *A* is an oil meter, *B* is the oil pipe, which increases in diameter in each section when passing through steam jackets C_1, C_2, C_3, C_4, C_5, to inlet to generator *D*, where it would be, preferably, between 2 and 3 inches diameter. Jackets have inlets for steam in top stuffing

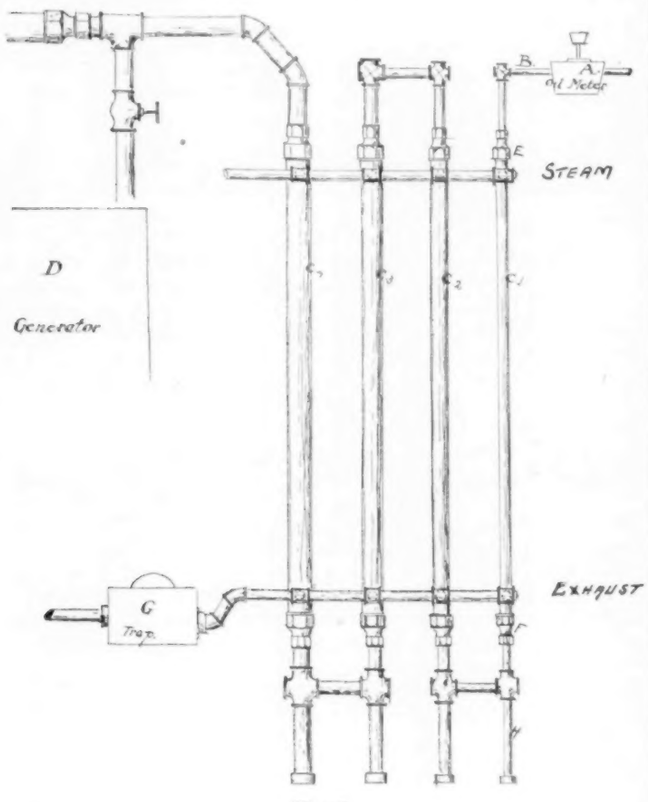

Fig. 3.

box *E*, and outlets for exhaust in bottom stuffing box *F*, the exhaust being automatically handled by means of trap *G*. At the bottom of each section of oil pipe is a drip-pipe *H*, which collects, by settling, the heavier matters or dirt which cannot be vaporized readily. I question if they are in any way actually needed.

*Made up of units to overcome external resistance, 71.83
Made up of units to overcome internal resistance, 893.81

The oil might be still further carried through heated chambers of temperatures of 600° to 800°.

In the Flannery machine it goes direct into an oil retort, and thence through the superheater, the oil retort being the cooler. The step from 312° to 1,500° of the retort is a great one; but I have pointed out that this is not so sudden as may seem at first sight. Practice bears me out; for at the Bay State works lampblack is unknown, and tar nearly so when naphtha was used. Since crude oil has been used, tar and condensation have appeared in considerable quantities, due to insufficient superheater area. I am at present working to get some exact figures on vaporization of oil, which, with the vaporizer, is an easy matter. Any figures that any members of the Associatiation may have as to the latent heat of vaporization, and the specific heat of naphtha and crude oil, and of oil vapor, would be of service to anyone studying this subject. I believe this subject deserves all the time for investigation that can be spared.

NOTE.—Naphtha will be all vaporized at 300° F., in which case steam of 80 lbs. pressure will give *all* the preheating desired. With crude oil it is necessary or desirable to heat further, if the circumstances will permit of it with success.

Discussion.

The President—The subject presented in this paper is an interesting one to all of us, and I hope that we may have a full discussion. I think, perhaps, Mr. Shelton has had as much experience as any in the use of oil for gas, and we shall be glad to hear from him.

Mr. Shelton—I have been extremely interested in Mr. Addicks' paper, and I think he deserves a hearty vote of thanks for the thoroughness with which he has gone into a subject which is sometimes overlooked by those engaged in the management of gas works. I think we are not apt to go very deeply into these details of temperature and various qualities of oil. We get the crude oil, pump it in the machine, and if it makes tar, lampblack, or what not we blame it on the gas maker. We do not give enough thought to the why, and wherefore, and reason of it. On the whole I agree with Mr. Addicks thoroughly. I believe in raising the oil gradually to a high temperature, and I think the remarks he has made, although directed mostly in the direction of water gas, apply equally well to the use of oil for enriching in retorts. It is a subject in which coal gas men are interested. I cannot entirely agree with him as to the non-desirability of heating the oil beyond steam heat. I think the utilization of the heat of the producer gas, or of the sensible heat of the hot gas passing off from the superheater, is a matter of very great importance. There is still another point—that in utilizing the heat of the superheater you are killing two birds with one stone. You are not only increasing the heat of the oil, and taking so much work off the superheater and the generator, but you are taking heat away from the hot gas. On the whole, I agree with the exhibition which Mr. Addicks has made, and congratulate him upon the thoroughness with which he has done it.

Mr. Addicks—I will say further that I think if you can get up some practical arrangement to heat the oil by using the waste gases it would certainly be desirable to do so. If you can save one per cent. in that direction I would not hesitate to do it. One point I made with respect to that, was that the amount of heat necessary to do this work is such a small item comparatively, I thought it would not cost more than the interest on the money invested and the cost of repairs thereafter. I think Mr. Shelton told me at one time he did something of that kind; and if he would explain it to us now it would be a gratification to me, at least.

Mr. Shelton—I agree that when we can only save one per cent. we ought to do it. We ought to save anything that we can. It has been the experience of the company that I am connected with that we can obtain a comparatively cheap and effective apparatus to heat the oil—to make the gas by the heat of the gas that is being made. In other words, by utilizing the heat of the gas passing out by interposing some means whereby to heat the incoming oil. It is more a question of the efficiency and durability of the apparatus than of the first cost of it. We have found that a very simple arrangement will fill the bill. It is cheap, it does not have to be cleaned at great expense, and the cleaning is done once a month to once a week, depending upon circumstances. In short, it has fully repaid our putting it in.

Mr. Addicks—Mr. Jones told me that he would be here, and I would rather have him make a statement as to his success in operating this plan. When he took charge of the North End works they had 18 retorts in operation where they now have 12; and the candle power is higher than before with 18. He saves about one-third of the coke, and has a better gas than he had before; he also did away with all the sight feeds that we so often see continually dripping in various works.

Mr. Neal—I am quite interested in this paper, because I am using the Granger-Collins water gas plant, and have tried to use crude oil, but without success. I have a great deal of trouble in the superheaters, from the deposition of lampblack, and they require constant care. I spray the oil in at about 40 pounds pressure in the generator, and it meets the gas just as it is passing from the generator into the superheater. I would like to ask Mr. Addicks if he is acquainted with the Granger process?

Mr. Addicks—Yes.

Mr. Neal—The oil is sprayed in at a very heavy pressure. It is previously heated in a cylinder by steam pipes, which raises it to a very high temperature. It seems to work very well; but I think that perhaps naphtha will work better than crude oil, although it is more expensive.

Mr. Addicks—I think it is a fortunate thing that you do heat it, because if you put it in cold, and sprayed it, it would have a worse effect. I think that the preheating which you give it now serves to counteract the spraying in at high pressure.

Mr. Neal—Do you think I could adopt that method so we could use crude oil in works of that kind?

Mr. Addicks—I think it is a matter for experiment with each style of generator.

Mr. Shelton—I would corroborate that also. I think crude oil is harder to handle than naphtha. Naphtha is a uniform and homogeneous substance, and you can take a single superheater and make gas without trouble. If you make tar or lampblack it is your own fault; there is no necessity for it. But with crude oil you have all sorts of things to contend with; and you have to handle it with a great deal more care. In Mr. Neal's case, where he has the Granger apparatus and a single superheater, it is necessary to watch the heats very closely so as not to crowd the apparatus in using crude oil. In that case I think heating the oil to the highest degree possible holds true of crude oil. That crude oil can be successfully used with the Granger apparatus or with any single form of superheater apparatus I would verify by calling upon Mr. Jenks, as I have the impression that he has used a great deal of oil in the same way that Mr. Neal desires, and with entire success. I think he would prefer to use naphtha if there was no difference in price; but a little difference in price is enough to cause him to favor crude oil.

Mr. Jenks—I was about to ask Mr. Addicks if he thought that the raising of the temperature of the oil before passing it into the apparatus compensated to any degree the lack of superheating surface before reaching the scrubbers.

Mr. Addicks—Unquestionably.

Mr. Jenks—That being the case, I would say "Amen" to an apparatus of that kind, and for this reason. Mr. Neal has facetiously referred to Woonsocket and its gas engine. We have a gas engine in Woonsocket. We also have a double set of water gas apparatus known as the Granger-Collins style, and we are very well pleased with it. There is, however, this feature about it, that in the use of Lima crude oil (and that is what we have always used) we find we have to be extremely careful, not on account of the stoppage in the superheater, however (for I have never seen a speck of lampblack in the superheater), but on account of the lampblack and tar collecting in the wash-box, or seal, as coal gas men would call it, between the superheater and the scrubber. There we have to clean periodically, perhaps, on an average, once a week. Sometimes we find it quite heavy, at others comparatively light, depending on the care that the gas maker has exercised in the operation of his apparatus during the time which has intervened. Mr. Shelton is quite right when he says I would indorse the use of Lima oil, especially when you consider the fact that naphtha costs twice as much. But my opinion is that the setting which the U.G. I. Company are now putting in, known as the double superheater setting, is far in advance of the setting we now have, especially when it is desired to use Lima oil. I think if Mr. Neal had another superheater he would get along without any trouble whatever. While I should like another superheater connected with our works, nevertheless I do not propose to change to naphtha on account of the difference in price. I would rather put up with the extra trouble that the heavy oil occasions.

Mr. Sherman—I would like to ask Mr. Addicks how many gallons of crude oil he uses to a given candle power; say, 22-candle power?

Mr. Addicks—I can only say in reply to that, that we are using naphtha and crude oil, and are getting above 5-candle power per gallon of naphtha. With the vaporizer our candle power went at once up to 6-candle power per gallon of naphtha used. When using crude oil we use it half-and-half, so that it is hard to determine exactly what we do. We are now running about 5-candle power, or a little over, to the gallon. That is our result so far. What the candle power is definitely, after it gets from the works, we have very little opportunity of knowing thoroughly and satisfactorily. I should say, though, that 5-candle power to the gallon would be a fair estimate for half-and-half.

Mr. Jones—I would like to call the attention of coal gas engineers to the advantages of vaporizing oil before putting it into the retort where it is used as an enricher. I regret very much that I was unable to be here to listen to Mr. Addicks' interesting paper; for I well know that he would not read any other kind of paper. Some time ago I began vaporizing, at the North End gas works, the naphtha before putting it in the retort; and the result has been that I am enabled to use the same amount of naphtha for enriching our gas with 12 retorts that I was before obliged to put into eighteen retorts, and with the further advantage that when I slack off the lid of an oil retort the retort is hot. Before, when I slacked off the pipes through which the oil was passed in, portions of the retorts were black, thus showing that by putting liquid naphtha into the retort we were overworking the retort. There certainly is an advantage in vaporizing oil before it is put into the retort, in the saving of fuel alone. At the North End works I am saving fuel in that way. I am getting better results from the naphtha used, and the naphtha is being converted into commercial gas; and I am positive that less of it is condensed out in passing through the apparatus. I think this matter is well worthy the consideration of all gas engineers who are using naphtha for enriching.

Mr. Prichard—Will Mr. Jones describe his vaporizer?

Mr. Jones—It is the vaporizer that has been already described by Mr. Addicks—a coil of naphtha pipes with a steam jacket.

Mr. Allyn—How do you introduce it into the retort?

Mr. Jones—Through an inch pipe, directly from the vaporizer. There is a main pipe leading from the vaporizer, and from that I take a pipe to each retort. The vapor is carried through a series of pipes inside of the retort. It is the well-known method of breaking up naphtha. There is one wrought iron pipe within another. The vapor traverses nearly the length of the retorts four times before passing up the stand-pipe.

Mr. Neal—How do you obtain your pressure—by gravitation or mechanically?

Mr. Jones—The pressure of the liquid when expanded to a vapor will carry it into the retort.

Mr. Lane—Have you done anything with crude oil?

Mr. Jones—I have not.

Mr. Sherman—How many gallons of naphtha will one retort take care of per hour?

Mr. Jones—We use 2,000 gallons in 12 retorts, and under the old method it would have taken 18 retorts to work it off properly.

Mr. Sherman—How much is that per hour for each retort? As we have used it we have thought that it would take care of about 7 gallons per hour without vaporizing.

Mr. Addicks—That brings up a question that I wanted to ask—and that is how many gallons went into the retort per hour? He is only using a 1-inch pipe—I have recommended 2½ to 3 inches—but we put in four gallons per minute.

Mr. Lane—With us we use five gallons on an average, and introduce it in much the same way.

Mr. Neal—Does Mr. Jones introduce the naphtha by spraying it over the coal?

Mr. Jones—No; the vapor is introduced into oil retorts.

Mr. Learned—What is the relative value of crude naphtha at 68, as compared with crude oil at 40 B?

Mr. Jones—As I have had no experience with crude oil at the North End station, owing to the locality, I cannot reply to that question.

On motion of Mr. Allyn, a vote of thanks was tendered to Mr. Addicks.

The next paper read was that by Mr. E. H. Yorke, of Brockton, Mass., entitled

PROBLEMS CONSTANTLY BEFORE THE GAS MANAGER.

Mr. President and Gentlemen:—By invitation of our Secretary, and feeling it to be the duty of every member of the Association to contribute to the success of the meetings, the writer reluctantly—because of their being abler hands in the Association to intrust the preparation of papers—consented to prepare a paper. Although able papers have been presented, touching, it would seem, on almost every theme, and the ground has been pretty thoroughly tilled, still even if old topics are again presented in a new garb, and the soil again turned over, it ought to yield a rich return. Your attention, therefore, is invited to some problems which are of necessity uppermost in the minds of every gas manager.

The life of a gas manager is one essentially of study. The complex and diversified character of his business calls for a broad and compre-

hensive knowledge of mechanical, scientific and commercial principles and methods.

Starting in his undertaking of managing the affairs of his company, he finds a capitalization, plant and income established by those before him, and which, even if of unequal proportions, he must deal with, so as to secure a reasonable return on the capital invested. Although limited in his opportunities for securing patronage by the confines of the town or city and its neighborhood in which his plant is established, he must so manage as to secure a sufficient sale of his product to meet his operating expenses, keep his plant in repair and order, and have a margin left for dividends. To these imperative requirements he will naturally supplement efforts to improve and increase the efficiency of his plant, to reduce the cost of his product to the lowest possible point, and to increase the revenue of his company. The successful accomplishment of these ends involves careful study and reflection, close application and untiring industry; for in no other way can the solution of the many poblems that will constantly present themselves to him be accomplished. Of the larger and more important of these problems, that of cost of production will claim his constant attention. The competition of other forms of lighting makes it imperatively necessary that the cost of production shall be at the lowest possible point, if the general use of gas is to be maintained. While the wide difference in the conditions in the different works admits of no general standard of cost of production being established, there are, however, certain details in the operations, the cost of which should be as low in one works as in another; and if the gas manager finds that another manager, in one of these details, has attained a lower cost, there is obviously an opportunity for him to lower his cost by the employment of the same means and methods.

In entering upon a contemplation of the problem before him he will naturally commence with the cost of materials; and in this detail of the cost of product can accomplish much by calculation and effort. In coal, the yield of gas, quality of gas, and amount of sulphur will be the leading factors, in determining which coal is the cheapest in the end. To illustrate: Assuming that coal A and coal B cost the same in the market, and coal A yields 400 feet of gas per ton more than coal B, and this gas is worth 15 cents, but the cost of purification is one cent per thousand, and enriching two cents more with coal A than coal B, it is obvious that coal B is the cheapest coal in the end. And thus with materials for enriching and materials for removing the impurities from the gas and details of expense of carriage and handling can the minimum of cost be attained by study and effort. Assuming that he has purchased his materials at the lowest possible cost, the next step will be to consider the economical treatment and realization of the maximum of values in them.

As coal is the basis of his product its manipulation comes first for consideration. Having secured a coal whose qualities average the highest, the first item of expense will be the moving of this coal and depositing in retorts or generators. In doing this there should be the least expenditure of manual labor and the economy secured, by a utilization of the laws of gravity, should be substituted, not with complicated and expensive machinery, whose maintenance is costly, but with simple and durable arrangements. Having placed his coal in his carbonizing chambers, at the minimum of cost, the next thing in order will be the realization of the greatest production of gas from the coal. Practice and experience have demonstrated that five cubic feet of gas is about all the gas the coal contains per pound, to be yielded by destructive distillation, and having secured this result the gas manager may reasonably dismiss this item in the cost as admitting of no further reduction.

His next inquiry must be with reference to the kind of apparatus required to produce the necessary results. If he contemplates the introduction of apparatus of new forms in substitution for the old, he will need to consider the outlay required, the advantages and economies to be secured, and should have unquestionable evidence that he is adopting apparatus that has proved good; inasmuch as expensive experiments are alike unprofitable to himself and his company. He will need to carefully analyze every detail, and the requirements in all its parts, and be fully assured before adopting the new apparatus that every requirement is fully met, and that it does not possess even a single fault which would make its use impracticable when put into practical operation. He should especially guard against allowing the advantages represented to obscure to his vision the defects, if any exist. It will be well for him to profit by the researches and experience of other managers, and the more information he acquires relative to their investigations the better he will be able to arrive at correct conclusions. But it will not be wise for him to be guided by the experience of a *single* manager; for he will find, while seeking information, this most anomalous state of things—namely, that while one manager has introduced a plan or apparatus and pronounces it a success, and is enabled with it to accomplish profitable results, that another engineer, held to be equally able, having tried the same plan, condemns it.

Returning to the point in his inquiries as to the best and most economical kind of apparatus for him to employ, he must determine which of the two processes—namely, coal gas or water gas—will best accomplish the desired end. The two primary factors in this question will be the cost and quality of the gas by the two systems. His investigations in this connection will develop these facts, namely: That with the water gas system he can distribute a gas of greater brilliancy without it smoking, when used in ordinary burners, than he can with the coal gas system. This will commend water gas in this particular, for his experience, doubtless, has convinced him, in these days of lavish illumination, that the more brilliant his gas the more successful it will be in its competition with other forms of lighting, and the more generally it will be used.

In steadiness of flame, he will find that the water gas flame is much more steady than the coal gas, and this will commend water gas; but as a slight off-set to this superiority of water gas he will find that its flame area is less than that of coal gas.

Thus far the weight of evidence has been in favor of his adopting water gas; and he must now examine it in other particulars to see if it possesses any defects which would overbalance its advantages. He will find that water gas contains at least 28 per cent. of CO, which increases its specific gravity to at least 40 per cent. above that of coal gas. He will find that the effect of this increased specific gravity is somewhat of a disadvantage in a two-fold way—to wit, the capacity of his mains for distributing a given quantity of gas will be 21 per cent. less than with coal gas, and the registration of gas by his meters will be diminished in like proportion; but this disadvantage will be partly off-set by diminished leakage. Of the character of the CO, while known that its effects are somewhat more detrimental to health than pure carbureted hydrogen, when breathed in excessive quantities for an extended period, but as numerous cases of asphyxiation have shown but little practical difference in the effect, the presence of CO in the gas need not be regarded as a serious objection.

The cost of the two gases will come next for consideration. He will find, on a make of 100,000 cubic feet per day, that the cost of the respective gases, at outlet of hydraulic main and superheater (the expense beyond will be the same with both gases), will be as follows, to wit:

Water Gas.

Materials—41 lbs. of fuel in generator, at $4.92 per 2,240 lbs.	09	cents.
10 lbs. of fuel for steam	02¼	"
4 galls. of oil, at 5 cents	20	"
Labor	03	"
Wear and tear	01	"
Total	35¼	cents.

Coal Gas.

Coal, less residuals	20	cents.
Enricher	05	"
Labor	08	"
Wear and tear	02¾	"
Total	35¾	cents.

He will, therefore, find, in the matter of cost, that one gas can be made, practically, at as low a cost as the other. His decision, therefore, must rest on other considerations.

He has already determined, in point of brilliancy and steadiness of flame, that it will be best for him to manufacture water gas, but in point of specific gravity, that coal gas would be best. This places him in a position where the conclusion is obvious that the best ends will be served by employing both processes, and manufacturing a gas of part water gas and part coal gas. His conclusion to employ a water gas plant will be strengthened by other advantages of value, which its possession will secure to him, namely, he will not require as much storage room for coal and coke, with the attended cost of construction and expense of repairs. He can manufacture the requisite volume of gas, with smaller purifiers and less holder room; he can better meet the fluctuations in consumption, and thereby increase the surety of his supply, than he can if he employs the coal gas system alone; and, finally, the possession of a water gas plant will diminish his dependence on labor; and organized attempts of labor, to force him to a compliance with its views, will be of but little avail. Having determined this detail in the problem before him, he will next consider the kind of benches he shall employ to car-

bonize his coal at the minimum of cost. The primary considerations in this question will be the cost of the bench, per 1,000 feet of gas, that it produces during its lifetime, its operating without trouble, its effective use of fuel, and its production of gas, per wages for labor. Taking up this question in its details, he must, first, determine whether he shall employ the horizontal or inclined plan of setting retorts. The economy of labor in the inclined system will commend it; but if he concludes to adopt the horizontal system, he must, first, determine the size of retorts he shall employ. The disadvantages of retorts of greater dimensions than 16 × 28 inches, 9 feet long, and the poor economy in using those of smaller dimensions, will commend this size to him. In number per bench, he will find that 7 will be more economical than a less number, while a greater number would bring disadvantages in furnace requirement and height of retorts.

At this point in his inquiries he must determine the kind of furnace that it will be best and most economical for him to employ. Whether simple furnaces and direct heating, or the employment of the regenerative principles, or the conversion of his coke into gaseous fuel in separate chambers, and burning these gases under his retorts, or the utilization of his tar for fuel purposes, will best answer the ends, can only be determined by a very thorough consideration of the principles involved and the action and effect shown by the different plans when used in practical operation. While he will not expect to be able to carbonize his coal with as low a number of heat units as is theoretically sufficient, he will hardly be satisfied to use a simple furnace and direct heating when its use requires at least 50 per cent. of his make of coke to carbonize his coal. He will, therefore, turn to the regenerative principles as a means for securing the greatest economy of fuel. The elements in this question (if he concludes to use a furnace of moderately simple construction) are: First, width and length of furnace, which should have a superficial area of at least 960 square inches; second, a depth sufficient to maintain a fire at least 30 inches deep; third, primary air flues of as large dimensions as the circumstances will allow, in order that excessive draught shall not be necessary; fourth, secondary flues of such form that the air currents will have to pass through a continuous flue of at least 28 feet in length; fifth, a continuous circuit for combustible gases, of at least 30 feet in length, with exits for secondary air at successive points; sixth, stack draught sufficient to maintain a vacuum of at least four-tenths of an inch. Supplementary to those essential elements will be the need that the combustion of the coke shall be moderately slow, the speed of the combustible gases not over 35 per second, and the temperature of the waste gases not over 500° F. If he secures a bench of this description, and is successful in the management of it, he will carbonize his coal with 25 per cent. of his make of coke, and will be able to work off 300 pound, 4-hour charges, will secure 63,000 cubic feet per bench, and may reasonably dismiss this detail, in the cost, as having accomplished the minimum of cost.

The next element in the cost of product for his consideration will be the cost of purification of his gas; and under this head may be included condensing and washing. How best to accomplish a thorough separation of the ammonia and tar from the gas without extracting a portion of the heavy hydrocarbons admits of much consideration. In the removal of the sulphur and its compounds and CO_2 the item of expense will be for materials for purification and labor in handling them. He will find that the cheapest effective purifying agent for extracting the sulphur is a mixture of coarse sawdust and oxidized iron borings. The removal of the CO_2 can be accomplished with lime, and if he have purifiers of a superficial area of 30 square feet per 15,000 feet of gas made, he can purify 50,000 feet of gas per bushel of lime. If he can find a means of revivifying his oxide in his purifiers he will have accomplished the minimum of cost in purification. But should he be unable to revivify his materials *in situ*, that plan which requires the least labor will obviously be the least expensive.

Beyond this point no large opportunities exist for effecting a material reduction in the cost of production; but it will be well for the gas manager to remember that in the minor details of expense ways and means can be found for reducing the cost of them.

While but a general outline of this problem and its solution has been attempted, its treatment has been sufficient to *suggest* the conditions, means and ends in the question of cost of production.

The next problem constantly before the gas manager, and which stands second in importance to cost of production, is the problem of how to increase the revenue of his company. In considering the opportunities and means for accomplishing the solution of this problem, it will be well for him to start with a consideration of the conditions of supply and management essential to its solution. Quality of gas; this should be as high as it will be judicious for him to distribute; for a high illuminating power will favorably influence the increased use of gas. Uniformity in quality is important, and variations in quality should be carefully avoided. The pressure on all the mains should be ample for all requirements; as insufficient pressure, due to mains inadequate in capacity to pass the requisite volume of gas, will obviously cause dissatisfaction among the consumers and effect a reduced sale of gas. Obstructed services, stiff meters, and riser-pipe elbows filled with rust should be sought for and remedied. Attention to consumers' burners, in seeing that they are of proper size and construction, and are properly adjusted, will do much towards increasing the general and satisfactory use of gas, while the judicious and free distribution of burners will materially assist this and return large profits for the outlay.

Cheerful and prompt attention to complaints, courteous treatment of consumers and an accommodating spirit are essential. The sentiment of the community in its relations to the gas company is an important factor. The management should be such that the company will be regarded as fair in its dealings, liberal in its spirit, and progressive in its aims and purposes. But dissatisfaction with the size of the bills will arise among the consumers, even if all the foregoing principles and methods are practiced. With these dissatisfied patrons much pains must be taken, and the reason why their bills are of such amounts made clear to them. It will be well to explain the principle and operation of the meter and its dial, and show them how errors in reading the indices will correct themselves. If this is not sufficient to satisfy them, the meter should be removed and tested on the meter prover in their presence. The imparting of this information will do much towards eradicating that element of distrust, the mystery surrounding the gas meter and gas bills, and which materially retards the more liberal use of gas.

Having determined on the principles and methods which he purposes to employ to establish conditions favorable to the retention of present consumers and addition of new, he will next turn to a consideration of the opportunities that exist, and means which he can employ to secure new users. In his examination of the opportunities for securing new patrons, he will find in that great body of non-users, which exist in every district supplied with gas, a prolific field for effort. In viewing this non-use of gas by many residents of his community, and in seeking for the reasons therefor, he will find them to be: First, the subject of gas not occurring to their minds; second, deficient appreciation of the value and advantages of gas; third, an opinion that it is too expensive. Of the various uses to which these non-users may apply gas, that of lighting, ventilation, heating of rooms, of irons for tailors and hatters' use, of coppers for tinware, of water for the bath, in cooking in families, restaurants, hotels and bakeries, and in gas engines for power purposes, will suggest themselves. These conditions in the non-use of gas call for his pursuance of the following, namely: First, he must bring to the minds of these non-users, the subject of gas; second, he must present its advantages in point of quality and volume of light, cleanliness, convenience and safety; third, he must present a simple statement of cost per burner per hour, and an approximate cost when used under stated conditions.

Of the means and methods which he may employ, it will be well to start with an exhibit at the company's office of the different kinds and sizes of burners, gas stoves, and a gas engine in operation, together with a generous supply of printed matter. Circulars through the mails and the columns of the press will serve as means to draw attention to gas and disseminate information relative to its advantages. Self-lighting burners furnish a minor means for promoting the use of gas, inasmuch as they enhance its convenience. The economy and advantages of the regenerator lamp will contribute to securing new uses, and its introduction, even at a low rental, will bring large returns in profit on sales of gas. The quality of light, steadiness and complete combustion of the gases, make the incandescent gas burner a useful agent in promoting the use of gas, and, finally, in appliances, the gas stove and gas engine offer a means to the gas manager of the largest character for increasing the revenue of his company.

In *methods*, that of personal solicitation will be the most effective; and in view of the field for effort and all the conditions, the employment of a thoroughly informed man, of good address, to solicit new takers ought to be attended with highly profitable results. This solicitor would find large opportunities for employing his talents and energies in increasing the use of gas for the various purposes to which it is applied, and doubtless would be able each year to secure a large number of new takers. He also could comprehend in his duties the inspection of consumers' lighting, and could do many things which would effect the retention of present consumers, the increased use of gas by them, and their better satisfaction with gas and the expense of its use.

One more important means suggests itself to the gas manager for in-

creasing the revenue of his company, and that is in extension of mains. This will be constant with the growth of the town or city, and as it involves a permanent increase in the capital invested in plant, and creates a constant expense in interest, leakage, care, repairs, depreciation, and liability for damages, it calls for very careful consideration. A presentation of all the details of this question would reach beyond the limits of this paper, and the author has, therefore, undertaken but a cursory consideration of the main factors in it and the means which may be employed in accomplishing an increase in the revenue of the company.

The next important problem constantly and permanently before the gas manager is the problem of electric lighting, its present and prospective effect on the gas business, and how best to deal with it. Now, that several years have elapsed since the general introduction of the electric light, both arc and incandescent, the use of it from its novelty and sentimental considerations, is rapidly fading away, and it is being weighed and measured by the hard and practical measurements of commercial estimate of value.

That people like and turn to new things is a self-evident proposition. The control of such a mysterious and subtle agent as electricity had a charm and fascination for most people. Everything electrical has been at the "top round" of popularity for several years; but, unless the signs are wrong, people are beginning to put the electric light in the balance and weigh it for its worth. The moving of a lever and the instant illumination of space remote has lost its charm. The practical turn of mind of people has commenced to assert itself, and the future of electric lighting is to-day somewhat problematical.

Such, then, is the status of the subject which is the basis of the problem now before the gas manager. In entering into a consideration of the details of this question, he will commence with the cost of generating and distributing electricity, and to avoid the confusion of the two lights, the arc and incandescent, will first consider the latter.

Information sufficient for his purpose will be acquired from the results as shown by established electric plants, and which show that the operating expenses have about equalled the revenue, although the charges for light have been about 50 per cent. above the cost of gas lighting—the number of candles being the same in both cases. Reasons for this will be found in the excessive wear and tear of the electric system. For these reasons the conclusions will be forced upon him that as a means for the profitable employment of capital, the business of furnishing electric light offers no inducement. In examining that aspect of the question which relates to the future of the incandescent electric light, he finds that these objections to its use present themselves, namely, that it is not a reliable light, due to the very nice conditions necessary for its perfect operation; that the lamp has a most uncertain lifetime, and subjects its user to much annoyance and trouble by its frequent breaking; that it steadily diminishes in candle power, in exact ratio to the time it is used. Its claims for superiority over gas are, that it is more convenient, gives off no heat, and doesn't vitiate the atmosphere of rooms. Examining these objections in detail, he finds that users are not much influenced against it because of its unreliability, or the frequent breaking of the lamp bulbs, or its inherent quality of diminishing in candle power.

The matter of its increased cost above gas lighting, if the considera tions of its claimed advantages have weight, will not effect its general use any more than the increased cost of gas over other lighting agents did when gas came into use, although the difference is less in comparison between electricity and gas. The conclusion, therefore, appears obvious in view of the extent that the incandescent light is established and used, and the length of time that it has been in use, that the probabilities point to its continued use. The gas manager, therefore, is confronted with these facts and this additional one, namely, he sees the steadily and increasing investment in electric lighting, which he realizes may be a menace to his business, hence it would be well for him to enter the field and retard this accumulation of outside inimical capital. If he now establishes an electric plant, and the events of the future should demonstrate that the electric incandescent *is* to do the lighting, he is in a position to maintain his business and find employment for the vested capital of his company.

Of the arc light there is but little to be said. Its value for out of-door illumination cannot be questioned. It occupies a field distinctly its own, and meets requirements in street lighting which cannot be met with gas. It is strongly intrenched in its position, and modern civilization will not consent to its displacement by any of the other forms of illuminants. Its position, therefore, is a prominent one, and must be recognized as such by the gas manager, and the earlier (if he has not already done so) he establishes an electric light plant, and secures a portion of the lighting (commercial and municipal) the better he will consult the ultimate interest of his company. He may not succeed in making any money for his company by distributing electricity, although from the advantages of his position, he will probably be able to earn enough to meet his operating expenses, with a margin for depreciation, but he will do that which it is eminently his duty to do, namely, to preserve and protect his company's interest.

In conclusion, while doubtless but little instruction will be found in my treatment of these problems, and issue will be taken with some of the conclusions, still if it directs attention to the subjects, and suggests new consideration of them, it will serve the useful purpose for which we are all assembled here to-day, namely, the consideration of the problems constantly before us. I thank you for your kind attention.

On motion of Mr. Stiness, a vote of thanks was tendered to Mr. Yorke.

(To be continued.)

Notes on Fuel Gas.

[Read by Mr. G. W. GOETZ, at the Washington Meeting of the American Institute of Mining Engineers.]

As is well known, the general use of natural gas in Pittsburgh and vicinity for domestic and industrial purposes has shown the great advantages and benefits to be derived by the use of a gaseous fuel. In order to ascertain and bring together all the facts relating to a large and economical production, purification, distribution and consumption of fuel gas made out of coal, the Fuel Gas and Electric Engineering Company, Limited, was organized under the presidency of George Westinghouse, Jr.

Interviews with leading authorities, in this country and in Europe, and a careful perusal of the enormous literature on this subject, brought out so many conflicting statements as to show the necessity of experiments, on a large and practical scale, to get accurate data to base ideas upon, and to ascertain the practical difficulties and merits of the respective processes proposed. A large number of experiments were made as to the possibilities of water gas, illuminating gas, producer gas and oil as fuels. A bench of retorts, producers, water gas apparatus, condensers, scrubbers, meters, a laboratory, and a holder, with a capacity of 50,000 cubic feet, being at disposal, it was possible to test the properties of the different gases obtained and to make mixtures of them in any desired proportion. All these experiments were controlled by carefully made gas analyses.

Interesting experiments on the diffusion of gases in a large holder when two gases off different specific gravity enter the holder alternately or at the same time were also made, as well as a large number of tests on the combustion of different gases. Mr. Frederick Siemens' statements on luminous flames and on heating by radiation were fully corroborated by carefully made tests; and gas burning devices, based on the radiation of heat from luminous flames, were developed which will give an efficiency of 84 per cent. of the original heat units in the gas, 54 per cent. of which results in radiant heat and is reflected on the floors of a room. Producer gas is undoubtedly the cheapest fuel gas that can be made, and answers all purposes where the air necessary for its combustion can be heated by the off-going heat of the furnace. Tests have shown, however, that producer gas carries too much nitrogen to permit its distribution to a community, since, in consequence of the presence of this constituent, its calorific power is too low, and its flame extinguishes so easily as to be dangerous for household use. It was important to know how many cubic feet of producer gas 1 ton of coal will give. Conflicting statements as to this point will be found in the literature of the subject, the figures ranging from 150,000 to 250,000 cubic feet per ton. To get at the actual figures by a practical test a ten days' run, night and day, was made. Pittsburgh coal of the following average composition was used:

	Per Cent.
Water	1.26
Volatile matter	36.22
Fixed carbon	57.98
Sulphur	0.70
Ash	3.78

In order to get a gas very low in carbonic acid, a much larger depth of fuel than is generally carried in producers was required; and, as it is impossible to poke by hand such a deep fire, a pneumatic rammer was placed upon the producer. This rammer consists of a cast iron ring so constructed that it will not only exert a pressure upon the coal, but also force the coal to the periphery of the producer—which is desired, because the gas has a tendency to creep up along the walls. The ring is raised by air pressure and allowed to fall upon the fuel, the stroke given depending upon the blow desired to make the fuel sink regularly.

A producer of the above type can burn from 12 to 15 tons of coal in 24 hours. A positive air blast is used, and steam is admitted under the grate, the admission of both being controlled by valves at the top of the producer. The result of a 10 days' run, carefully metered, showed that 1 ton of Pittsburgh coal will give, on an average, 131,280 cubic feet of purified producer gas, corrected for barometer and temperature. The gas from the producer passed through scrubbers, condensers and meters, and thence into a holder of 50,000 cubic feet capacity. The carbonic acid in the gas was at times as low as 1.4 per cent., but the average percentage was about 3.4 per cent., at a pressure of 4 inches of water. With a pressure as low as is generally carried on producers in connection with steel melting furnaces, the carbonic acid could have been easily kept at 1 per cent. with such a deep body of fire in the producer. The average composition of the gas was:

CO_2	3.4
CH_4	3.1
H	9.2
C_2H_4	0.8
CO	25.3

The remainder was mainly nitrogen. This experimental determination of the amount of producer gas obtainable from 1 ton of Pittsburgh coal, will enable engineers to judge what they are likely to get from other coals. An interesting fact as to the heat units required to puddle 1 gross ton of pig iron was determined by the engineers of the above company. The experimental gas furnace employed, with regenerators for air only, was designed and superintended by W. F. Zimmermann.

The ordinary single handed puddling furnaces used in Pittsburgh consume about 36,000,000 British heat units per gross ton of pig iron, whereas when gas is employed about 14,000,000 heat units will do the same work. It was found that 13,250 cubic feet of natural gas, with 1,100,000 heat units per 1,000 cubic feet, will puddle 1 gross ton of pig iron, whereas by using a gas with nearly 300,000 heat units per 1,000 cubic feet, 47,000 cubic feet were consumed, and by using a gas with 266,000 heat units 54,000 cubic feet were used to puddle 1 gross ton of pig iron. The number of cubic feet of gas consumed, multiplied by the respective heat units in 1,000 cubic feet, will, in each instance, give somewhat above 14,000,000 heat units.

These results clearly show that if all circumstances as to the production and consumption of heat could have been considered in these experiments the amount of gas used in each case would have been exactly inversely proportional to the heat units contained in the gas. This result could, of course, be expected from the laws of heat, but it is, nevertheless, an interesting fact to have it experimentally demonstrated on a large scale. This result on puddling, and similar results on the consumption of different gases to evaporate water, combined with many other considerations, has led to the important conclusion that it is not advisable to distribute a gas for domestic use with a comparatively low amount of heat units per 1,000 cubic feet. The higher the heat units per 1,000 cubic feet the better, especially when the gas is to be widely distributed.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Salem (Mass.) Gas Light Company is soon to occupy its new plant on Bridge street, which is very complete. Mr. John W. Leighton, of Boston, has been chosen President. One particular advantage of the new establishment is the facility with which supplies can be handled.

THE following letter will prove of interest:

SPRINGFIELD GAS AND ELECTRIC LT. CO.,
SPRINGFIELD, MO., March 7, 1890.

To the Editor AMERICAN GAS LIGHT JOURNAL:—I notice your remarks in your valuable JOURNAL, of March 3d, about the Laclede Gas Light Company adopting the Coze system of inclined benches. I am pleased to see it because it proves to me that I have not gone far astray in adopting this system here. My excavation is almost ready, and I hope to lay the foundation stone next week, and hope to have the bench under fire at the time of the convention, so that, if it cannot be seen in St. Louis, if the members will come to Springfield I will be glad to see them and show them what I now call improvements upon the original Coze bench in St. Louis. I have had the honor to place the first order for this style of bench with the Laclede Firebrick and Manufacturing Company. Yours, truly, JOHN GIMPER.

AT the annual meeting of the Memphis (Tenn.) Gas Light Company the Directors chosen were Messrs. William A. Williamson, W. S. Bruce, Napoleon Hill, Enoch Ensley, N. M. Jones, John S. Bransford, and R. Dudley Frayser. This selection shows that Mr. Samuel Prichitt has been succeeded by Mr. Bransford, while Mr. R. D. Frayser takes the place of Mr. Henry Craft. It has been well known for some time that Mr. Prichitt was not enjoying the best of health, but it was hoped by his friends, a wish that was also shared by the stockholders in the Memphis Company, that he would still consent to remain in harness. His declination, however, was positive, and we join with the fraternity in an expression of regret over the first step in his retirement from the active practice of his profession, whose membership will ever hold him in affectionate regard. Mr. N. M. Jones was re elected President, and Mr. Joseph Craig will also retain the position of Secretary.

WHILE regretting his declination to longer serve on the executive management of the Memphis Company, we are on the other hand able to congratulate Mr. Prichitt on the fact that he is to retain his connection with the Nashville Company, of which enterprise he is virtually part and parcel. The Directors chosen at the last meeting (6th inst.) the Nashville Company are: Messrs. Samuel Prichitt, T. D. Craighead S. M. Murphy, V. L. Kirkman, Thomas Plater, Jas. Simmons and M. M. Gardner.

JOHN DEVOR, President of the Greenville (O.) Gas Light Company, has made an assignment. Among those who figure on his list of creditors we are sorry to note the name of R. R. Dickey, of Dayton.

FROM a recent issue (6th inst.) of the Chicago *Tribune* we take the following: "F. M. Charlton, through Beck & Charlton and L. P. Wilcox, solicitors, has filed a bill in the Chancery Court asking for the appointment of a receiver to take charge of the property of the Chicago Gas Trust, to sell its assets, franchises and privileges, and to wind up its affairs, under the direction of the Court. In the meantime it is asked that its officers, directors, agents, and confederates be enjoined from buying or selling the stocks of the associated gas companies, and from exercising any supervision or control over their acts. The grounds are that the Trust is not carrying on the business of manufacturing and selling gas and electricity as it lawfully might, but on the contrary is continually purchasing and selling the stock of the four companies composing it; that it controls their management by holding a majority of the stock of each, and that by its manipulations the interests of the stockholders are suffering. In 1887 the Chicago Gas Trust Company was organized under the general law. Its purposes as set forth in the charter were to build, erect, purchase, lease, establish, maintain, and enlarge works in the city of Chicago and elsewhere for the manufacture, supply, sale, and distributien of gas and electricity, and to purchase and hold the stock, property, plant, and goodwill of other companies. The capital stock was $25,000,000, consisting of 250,000 shares of $100 each. Charlton claims that he is a holder of shares in the Trust, which would be of great value to him if the Company would erect the necessary buildings and apparatus for the manufacture and distribution of gas and electricity. He claims that the officers of the Trust never had any intention to carry out the object set forth in the first clauses. On the contrary, it has conspired with the officers of the Chicago Gas Light and Coke Company, the Peoples Gas Light and Coke Company, the Consumers Gas Company, and the Equitable Gas Light and Fuel Company, of Chicago, to control a majority of the shares in each, and thereby to suppress competition, to destroy their diversity of interest, and to build up a monopoly in the manufacture and sale of gas in Chicago. By reason of this combination and conspiracy, and because the Trust does not go ahead and make and distribute gas, Charlton claims that his stock is more than 50 per cent. below par, and is likely to become, through manipulation of the markets, practically worthless. Further, it is set forth that the Trust organized for the purpose of crushing 'competition,' is not only destroying the value of the stock owned by him, but is creating a monopoly dangerous and injurious to the best interests of the people. He claims that under the decision of the Supreme Court, in the case of 'The People, *ex rel.* Peabody vs. The Chicago Gas Trust Company,' rendered last November, the Trust should be enjoined." Mr. Charlton and his attorneys have managed to put together a goodly share of claptrap in their "complaint."

THE authorities of Salem (Ohio) have determined to abandon the use of incandescent electric lamps for lighting the streets. Arc lights will take their place.

THE shareholders of the Belleville (Ills.) Gas Light and Coke Company and of the Belleville Electric Light and Coal Company will, on April 1st, vote on a proposition to consolidate.

ONE of the Helena (Montana) City Fathers created a hearty laugh in the meeting room a fortnight ago by gravely remarking that the local Gas Company was to be commended for its liberality in reducing the gas rate from $3 to $2.50 *per gallon*. A rather condensed way of putting it.

CONSIDERABLE plant additions will be made to the Omaha (Neb.) Gas Manufacturing Company's system.

DR. MORFIT is responsible for the introduction of an ordinance in the First Branch of the local government of Baltimore to regulate the "laying of gas and other pipes, railroad tracks, electric light, telephone and telegraph wires, in, upon, under or over the streets, lanes and alleys," of the city. Hereafter when any corporation or person is desirous of using the streets for the purposes named they must first obtain written permission from a board, composed of the Mayor, City Commissioner and City Comptroller, to be granted upon such terms and conditions, and subject to the payment to the city for any such privilege of such "equitable sum of money as may be determined by the board." The ordinance was referred, in which state it is hoped it will remain; for, certainly, a rarer gem in the line of a plan for extortion, it has not been our fortune to encounter.

A SUIT for $5,000 damages has been instituted by Albert I. Thompson against the Worcester (Mass.) Gas Light Company, who asks for this sum because of personal injuries received by him through an explosion of gas on the evening of February 25. Plaintiff alleges that a gas meter had been set in a faulty manner by the agents of the Company in a certain place in the Esterbrook Building, and because of that faulty construction, plaintiff (whose duties obliged him to ignite a match close to the meter) received a severe shock and serious burns in the explosion of gas that followed. Defendant replies that plaintiff acted wrongly in lighting the match, because he must have known that such an act—he was aware that gas was escaping either from the meter or from some break in the service close to it—would imperil his person; also, that if there was a defect in the setting of the meter, it was his or the tenant's place to notify the Company. The case will be tried at the April term of the Superior Court.

THE street lighting service of Lincoln, Neb., calls for the maintenance of 298 gas lamps and 224 gasoline lamps. The city owns all the gas lamps, posts, etc., and the Gas Company furnishes gas and lights and extinguishes, receiving pay therefor at the rate of $1.75 per lamp per month—moon table. The gasoline lamps, posts, etc., are owned by the contractors, who maintain and repair the same, and also furnish lighting material, and light and extinguish, for the sum of $1.33⅓ per lamp per month. The City Engineer estimates that each gas lamp—the city making all needed repairs to same—is a tax on the treasury in the sum of $2.16⅔ per month.

THE proprietors of the Helena (Montana) Gas Light and Coke Company have reduced their selling rate from $3 to $2.50 per 1,000 cubic feet.

THE City Council of Omaha, Neb., have passed an ordinance creating the office of City Electrician.

THE Boston *Advertiser* says, in a Washington "special," dated the 6th inst.: "The recent Patent Office decision in the interference case of Wm. Stanley, Jr., against M. M. Slattery, better known as the Fort Wayne case, is one of great importance as affecting almost every electric light plant in the United States. The case was one concerning the right to use a converter in electric lighting, each party claiming prior invention of a system in which an adaptation of the converter to the dynamo by the length of its primary coil is a distinguishing element, and one which was not disclosed in some or all the prior publications in evidence. In the Patent Office decision it is held that the entire case turns on the fact that it is not regarded as essential to the invention in issue that in the construction of the converter the length of the primary coil should be made the one variable element to be adjusted to other conditions presented; on the contrary, it is believed to be sufficient to satisfy the terms of the issue that the length of primary coil be suitable to the other conditions presented, whether the length of coil be varied to fit the conditions, or the other conditions are varied to fit the length of the coil. It is thought that if the issue were of narrower construction the primary examiner would have required further terms of limitations to the claims involved. In accordance with this rule, priority of invention was awarded to Stanley, whose patent is the property of the Westinghouse Company."

MR. GEORGE W. MORRIS, President of the Louisville (Ky.) Gas Company, has notified the residents that the Company is ready to distribute a non-illuminating fuel gas at the rate of 50 cents per 1,000 cubic feet. Perhaps Mr. Barret could be prevailed on to write something for the JOURNAL respecting the fuel gas plans prepared by him for his Company.

THE Fremont (Neb.) City Council has decided to submit a proposition to the people to vote $10,000 for the construction of a municipal electric lighting station.

MR. THOS. FLANAGAN, has been elected Superintendent of the electrical department of the Portsmouth (N. H.) Gas Light Company. He has practically filled the position for some time past, and is in every sense equipped to carry on the duties of his post.

THE Oswego (N. Y.) Gas Light Company has reduced the gross rate to $1.85 per 1,000 cubic feet, with 10 cents off for prompt payment, or a net rate of $1.75. The Company has also notified its consumers that it will hereafter supply incandescent electric lights on an all-night circuit without any change in price of service—60 cents per month for each 16-candle power lamp.

THE following is from the annual report of Mr. W. C. Adams Superintendent of the Richmond (Va.) City Gas Works, respecting the operations of the gas department for the year 1889. Having called attention to the fact that despite the more general use of electricity for illuminating purposes, the receipts for gas were only $1,832.64 cents less than in 1888, Mr. Adams goes on to say: "I would especially call attention to the limited purifying surface of the works. This is a most important factor in the manufacture of gas, and unless something is done to increase the capacity for purifying we will have serious trouble from impure gas during the next winter. The new retort house containing 10 benches of 6's was completed last April, and the results from these benches have been perfectly satisfactory. The walls of the old retort house were raised 10 feet, and a new roof put on, which conforms the old building to the new, and adds greatly to the comfort of the men. We are still in urgent need of a new holder, and as soon as practicable one should be constructed. The use of the incandescent electric lights reduced the revenue of the department to a slight extent last year, but we are gradually regaining our customers, and I think we will send out more gas in 1890 than in any preceding year since the works were started. I would recommend that efforts be made to increase the consumption of gas by the use of gas stoves. This branch of the business admits of large development and would greatly add to the revenues of the gas department. In Springfield, Mass., over 1,900 heating and cooking gas stoves are now in use. I think the time is near at hand when we will be able to reduce the price of gas to $1.25 per 1,000 cubic feet. We should at once adopt a graduated scale of prices, by which large consumers could be offered inducements to continue the use of gas, for unless we do we will find that more of our best customers will substitute electricity for gas. It is the large consumers that are leaving us, and we must meet the competition that confronts us, or continue to witness a falling off in our gas receipts."

AT a meeting of the Committee on Manufactures (Massachusetts Legislature), held on the 5th inst., a hearing was had on the petitions of Charles E. Bowers and others and Michael Doyle and others for legislation authorizing cities and towns to manufacture and distribute gas and electricity. Mr. C. P. Greenough appeared for the Boston Gas Light Company, E. W. Burdett for the Massachusetts Electric Light Association, and ex-Senator John C. Crosby for the North Adams Gas Light Company. Mr. Bowers submitted a bill which provides that any city or town may establish or purchase and maintain plants for the manufacture and distribution of gas or electricity for light, heat and power, upon the two-thirds vote of the City Council, in two successive years, in cities, ratified by the people, and in towns by the two-thirds vote of the legal voters at two annual meetings. The bill further provides for the issue of bonds, outside of the limit of indebtedness, the amount of such bonds to be not over 5 per cent. of the town's or city's indebtedness. The plants may be enlarged with the consent of the council or selectmen as above. Assessments may be made upon the owners of premises, but their payment is not obligatory unless gas or electricity is supplied, and the city or town is not to be compelled to furnish gas or electricity to any person or corporation, except by the order of the Gas Commissioners, after proper hearing. The bill provides that the business shall be given in charge of a manager, and that the net profits shall not exceed 8 per cent. Mr. Bowers, in support of his project, referred to the Danvers bill rejected by the Legislature of last year, and read from opinions expressed by the Boston Ex-

ecutive Business Association, and various other parties, in favor of municipal control and against corporate monopolies. In Philadelphia, where the price to consumers is $1.50 per 1,000 feet, the net profit of the municipal gas works in 1888, taking into account what is distributed for city purposes, was $1,006,134. Included in the Bowers references were extracts from the *Forum*, the *Nationalist*, and the *North American Review*. He said that petitions had been received from between 12,000 and 13,000 people, from 116 towns, in favor of the proposed legislation. Miss L. J. Robinson raised the point that the early laws tended to protect the people in their individual rights, and that they should not be "trampled upon" by corporate monopolies. Frank Parsons favored any bill which should give to each community authority to elect the manner in which gas and electricity should be manufactured and distributed. He claimed that neither corporate monopoly nor private competition could be depended upon in justice to the people, and said that municipal ownership was the only equitable system, as had been shown in the experience of cities which had adopted it. Speaker Barrett appeared in response to the vote of the town of Melrose, which desires to be allowed to manufacture and sell gas and electricity to its inhabitants. Mr. Barret said that there was a feeling in the community, no doubt intensified by the consolidation of the gas and street railway companies, which had increased prices or at least had not diminished prices commensurate with increased advantages, that the different cities and towns should be allowed to choose for themselves in what manner gas and electricity should be manufactured and distributed. This was a question of principle and not one of profit. It did not make any difference whether the town or city made money or not. The only question of importance is whether or not the cities and towns should be allowed this privilege. Mr. Lane and Levi S. Gould, of Melrose, ex-Mayor Raymond, of Salem, P. F. Shevlin, of South Boston, Dr. James Waldock and Frank C. Coffin also addressed the committee either upon the general question or upon some especial or local phase of it. The hearing was then adjourned.

MESSRS. R. D. WOOD & Co., of Philadelphia, Pa., have been awarded the contract for the construction of the new holder at the works of the Citizens Gas Light Company, Newark, N. J.

ALL the preliminaries in respect to the purchase of the Rockford (Ills.) Gas Light Company by the American Gas Company, of Philadelphia, have been completed. The transfer involved the payment of about $300,000.

WE are in receipt of a copy of a circular recently issued to the gas consumers of Warren, Ohio, by the proprietors of the Warren Gas Light Company, from which we learn that the net rate for gas, from and after the first prox., is to be $1.50 per 1,000 cubic feet. This is a concession of 30 cents per 1,000, and insures very cheap light to the residents of Warren. This is the fifth reduction that has been made by the Company since 1878, and that it is likely to be tried again is evident from the language of the last paragraph of the circular which reads: "We wish again to impress upon you the fact that the faster the consumption of gas increases in Warren the sooner can the price be further reduced." That the use of gas for purposes other than lighting finds favor in Warren, we may note that over 100 stoves are now in use there.

THE Adams (N. Y.) Gas Light Company has thus perfected its organization: President, N. M. Wardwell; Vice-President, A. B. Hudson; Secretary and Treasurer, E. C. Bessie; Superintendent, R. P. White.

IN the reorganization of the Kenton (O.) Gas and Electric Company the capital stock has been put at $50,000.

THE capital stock of the Toraya (Philadelphia) Patent Gas Company is $20,000, and the original Board of Directors comprised Messrs. Jose F. Toraya, Jose Vivo and Chas. C. Haines.

THE electric light plant recently determined upon by the proprietors of the Johnstown (N. Y.) Gas Company is being installed.

AT a meeting of the Troy (N. Y.) Contracting Board, the subject under consideration being the bids for public lighting, City Engineer Fuller moved that the contract for street electric lighting be awarded to the Troy Gas Company, for 5 years, at 39½ cents per light per night, for lights of 2,000-candle power. The motion was adopted. Comptroller Roche then moved that the Troy Electric Light Company be authorized to keep on with the public lighting at the ruling figure of 43½ cents per night for each lamp until the Gas Company is ready to go on with the new contract. There is small doubt that the Gas Company will soon absorb its rival.

AT a meeting of the Directors of the National Gas and Electrical Construction Company, Boston, Mass., Benjamin F. Butler was elected President, and Fred. Whittemore, Clerk.

AT a meeting of the Engineers' Club (Philadelphia, Pa., March 1) Mr. Henry G. Morris described a new method of sinking dies, and followed his remarks by presenting a beautiful specimen of the results accomplished. He stated that these results could be obtained by this process at a cost entirely insignificant when compared with the cost by the old method.

THE City Council of Macon, Ga., has decreed that the electric lighting towers (6 in all, 150 feet each in height, and erected at a cost of $5,000) must be torn down by May 1st. The reason given is that the "towers are dangerous."

C. O. FRENCH, Solicitor for the Utah, Nevada and San Francisco Railroad, has applied to the City Council, of Salt Lake, for a franchise for the construction and operation of a gas plant. He proposes to supply illuminating gas for $2 and heating gas for $1 per 1,000 cubic feet. While not positive about the matter, we are inclined to think that French is backed by certain parties who are interested in the Jackson (Mich.) plant.

Economy of Fuel in the Distillation of Ammoniacal Liquor.

In these days of small margins of profit the manufacturer can no longer afford to throw anything away until he is quite certain that its capacity as a revenue producer is exhausted. Applying this principle to the distillation of ammoniacal liquor in the column still, says the *Chemical Trades' Journal*, one is struck by the fact that in the process as ordinarily conducted the spent liquor leaves the still at a boiling temperature, containing the heat equivalent of a considerable quantity of fuel. These few remarks are intended to show how, in the case of the Davis still, this heat may be recovered and utilized. In the case of the Davis still the spent liquor escapes from the apparatus through a series of U-tubes. It is proposed to cause these U-tubes to pass through a water-tight box of any convenient shape and material, and the ammoniacal liquor to be treated is conducted through this box on its way to the still, so that it becomes heated by contact with the U-tubes, through which the spent liquor is escaping. In one works this arrangement has been already adopted, and answers very successfully. The temperature of the ammoniacal liquor is raised to 108° F., while the spent liquor only registers 112° F. as it escapes to the drain. Where other means are adopted for the pre-heating of the ammoniacal liquor, the "Economiser" (as the apparatus is called) may be employed to heat water for the boiler supply, or for any other purpose. In certain cases it may be desirable to substitute a coil of pipes for the series of U-tubes, but if this is done care must be taken to so arrange the coil that it forms a seal equivalent in its effect to the U tubes. These outlet tubes or coils may be best cleaned out by connecting temporarily with a high pressure water supply, communication with the still being, of course, cut off while the flushing or cleansing operation is going on. A mixed jet of steam and water, where it can be got, answers this purpose very effectually.

It may be thought by some that the saving to be effected by the use of the "Economizer" is insignificant. Compared with the differences between "ancient" and modern stills, this saving may appear a small one; but it must be remembered that the field of the economist is much more restricted in its area than was the case some few decades ago. We are very much nearer the goal of theoretical perfection, and our rate of progress must be expressed in smaller units. Those manufacturers who fail to appreciate small individual improvements are considerable losers in the aggregate, and are among the first to drop out from the struggle where the fittest only survive. The proverbial sweetness of little fishes has its parallel in the acceptableness of small economies.

The Market for Gas Securities.

The city share market during the week has remained in a quiet state, but the undertone is all in favor of higher prices. There was no considerable variation in values, and the trading was light. In connection with the purchase of the artificial lighting and gas fuel supply of Indianapolis, Ind., we note a rather curious denial by President Graham, of the Equitable Company of this city, who wishes it distinctly understood that that Company as a Company had nothing to do with the purchase. No one really supposed that such was the case; but we presume it was pardonable to infer (from the fact that a circular calling attention to the purchase was dated from the Company's office on Third avenue) that some of its directors were interested in the transfer.

Rumors are rife that the Citizens Company, of Brooklyn, will be called to account by the Fulton Municipal Company, in respect to the proposition of the owners of the former that they think it is time to make gas instead of peddling it. The increase to the Company's stock has been sanctioned by the required assent of the stockholders. Nassau gas is steady, at 120 to 122, the certificates being quoted at par to 102.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

March 17.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	95⅞	96⅛
Central	500,000	50	—	—
" Scrip	220,000	—	—	—
Equitable	4,000,000	100	119	122
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	116	118
Mutual	3,500,000	100	110½	—
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co —				
Common Stock	5,000,000	100	—	45
Preferred	5,000,000	100	84	87
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	109	111
Citizens	1,200,000	20	—	68
" S. F. Bonds	320,000	1000	102	103
Fulton Municipal	3,000,000	100	123	—
" Bonds	300,000		105	—
Peoples	1,000,000	10	80	—
" Bonds (5's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	—	100
Nassau	1,000,000	25	120	122
" Ctfs	700,000	1000	100	102
Williamsburgh	1,000,000	50	124	—
" Bonds	1,000,000	—	108	112
Out of Town Gas Companies.				
Boston United Gas Co. —				
1st Series S.F. Trust	7,000,000	1000	93	93½
2d " "	3,000,000	1000	71	72
Bay State Gas Co.—				
Stock	5,000,000	50	24	25
Income Bonds	2,000,000	1000	—	—
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds	45,000	—	—	—
Chicago Gas Trust	25,000,000	100	42¼	42⅜
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	—	93½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	97	—
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	99
2d "	2,500,000	1000	96	100
Consumers Gas Light Co., Jersey City	2,000,000	100	15	25
Bonds	600,000	1000	80	—
Cincinnati G. & C. Co.	6,000,000	100	201	203
Consumers Toronto	1,000,000	50	190	200
Central, S. F., Cal.			80	90
Capital, Sacramento, Cal			58	
Consolidated, Balt.	11,000,000	100	54	54¼
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	75	90
Bonds	250,000		—	—
Hartford, Conn	750,000	25	102	108
Jersey City	750,000	20	186	190
Laclede Gas Light Co., St. Louis, Mo.—				
Common Stock	7,500,000	100	15	17
Preferred "	2,500,000	100	—	—
Bonds	9,034,400	1000	84½	—
Louisville, Ky	2,570,000	50	125	130
Little Falls, N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	48	51
" Bonds.	240,000	100	103	—
New Haven, Conn		25	200	—
Oakland, Cal.			35	35½
Peoples, Jersey City		—	60	61
" " Bonds			—	—
Paterson, N. J.		25	99	102
Rochester, N. Y.		50	99	100
Syracuse, N. Y.	500,000	25	—	—
San Francisco Gas Co. San Francisco, Cal.	10,000,000	100	55½	55¾
Washington, D. C.	2,000,000	20	200	208
Wilmington, Del.		50	88	90

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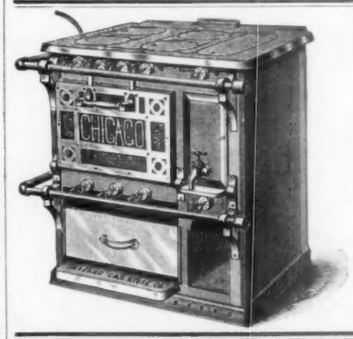

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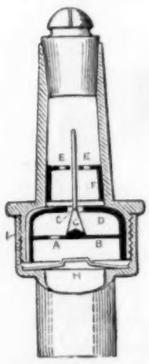

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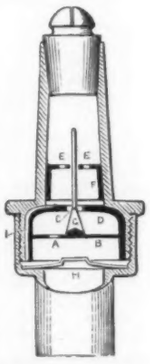

EXPLANATION OF CUT.—Gas passes through opening *A* in piston *B*, thence through opening *C* in inverted cup *D*, and through openings *E E* in guide-plate *F*; the flow being governed by the position of the conical valve *G* in respect to the opening *C*, a position which is automatically regulated by variations in the pressure of gas on piston *B*. Thus, if the pressure is excessive, the piston will be forced upward and the valve *G* elevated so as to restrict the freedom of the flow through opening *C*, the piston descending and the valve opening as the pressure is diminished.

This Burner is a Perfect Pressure Regulator, maintaining a uniform pressure at point of ignition at any pressure above $\frac{6}{10}$ in.

Careful Photometric tests show a gain of *fifteen per cent.* in illuminating power *over* the Argand burner. Warranted to give the same amount of light as other burners at from 25 to 50 per cent. less cost, and not to corrode or clog in any manner.

Manufactured in 2, 3, 4, 5, 6, 7, and 8 ft. sizes, and larger or smaller or intermediate fractional sizes to order.

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In ordering Burners state whether for Coal Gas, Water Gas, Oil Gas, or Natural Gas; and also give specific gravity and illuminating power of same. Special Burners will be adjusted on demand for any quality of gas, and warranted to consume any required amount of such gas.

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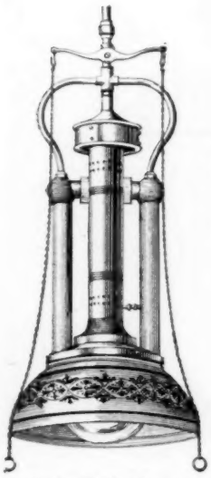

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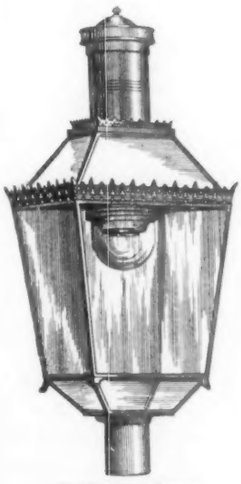

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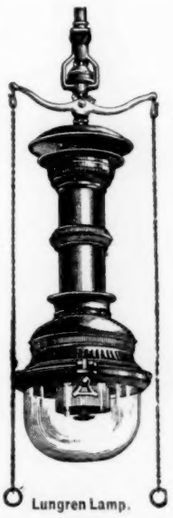
More than 25,000 Lungren Lamps are now in use. Testimonials, references, or any desired information will be cheerfully given.



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At the Fall Session of the Board of Supervisors of Winnebago County, held at the County Court House, Oshkosh, Wis., Nov. 26, 1889, the report submitted by Mr. C. W. Cook, Chairman of the Committee on Public Buildings, recommending the use of the Welsbach Incandescent Gas Burner in the Buildings under their charge, was unanimously adopted, because of the extreme economy in the consumption of Gas and the superior character of the light obtained.

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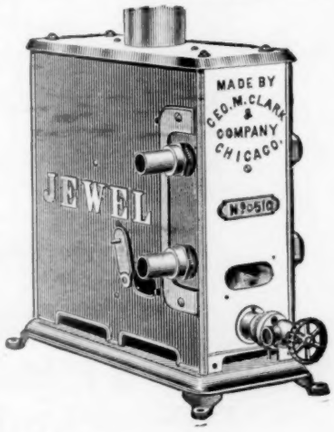

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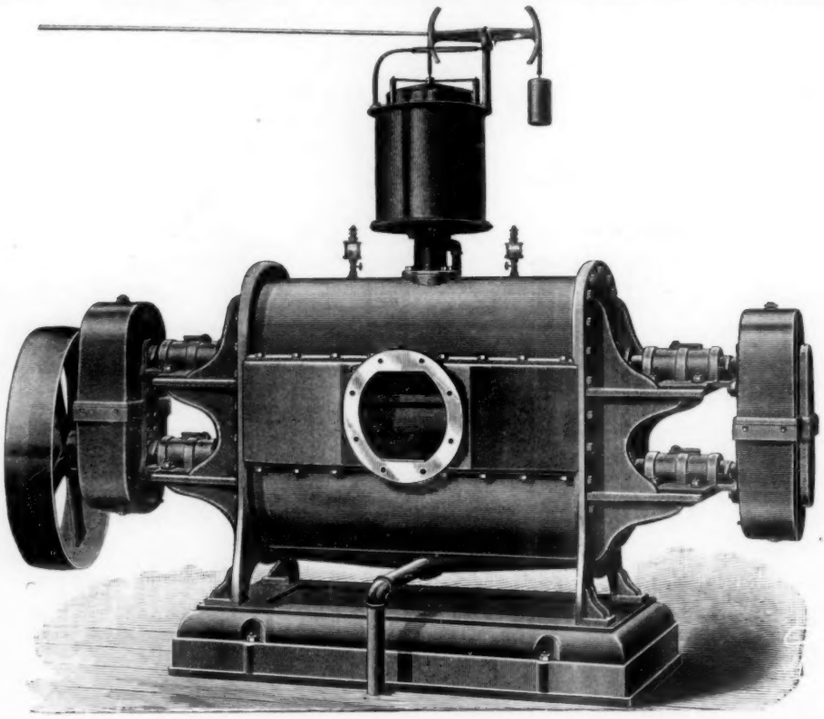

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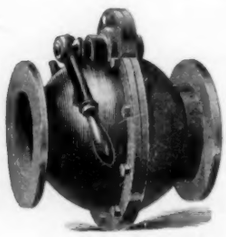

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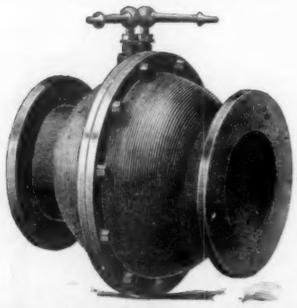

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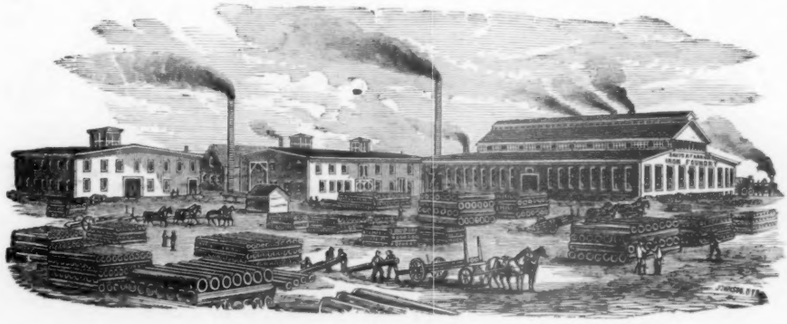

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Gas and Water Pipe, Flanged Pipe,

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THE
WALKER TAR AND CARBONIC ACID EXTRACTOR.

A very general demand exists, in both large and small Gas Works, for an apparatus that will be absolutely efficient in the removal of the tar which passes the hydraulic main and condenser. Many attempts have been made to accomplish this, but, I believe, without success, until the introduction, five years ago, in England, of the C. & W. Walker Patent Tar and Carbonic Acid Extractor. During these years this apparatus has been adopted by many of the most prominent Engineers, not only in England, but also on the Continent of Europe and in other parts of the world. It is only necessary to give here a partial list in order to convince any intelligent American Gas Engineer that this machine must have succeeded fully in accomplishing the desired results.

The following Engineers have personally given permission to refer to them:

G. C. Trewby, Esq., Engineer-in-Chief of the Gas Light and Coke Co., London. The manufacturing plant at Beckton is built in complete sections of 3,000,000 cubic feet capacity each. A Walker Tar Extractor has been fitted to each one of these sections. This was done after a long and thorough trial on one of its sections. The Tar Extractor has been supplied to other works of the Gas Light and Coke Co., including those of which John Methven, Engineer of the Gas Light and Coke Co. at the Nine Elms Station, is in charge. Also to G. E. Stevenson, Peterborough Gas Works; B. Green, Mitcham and Wimbledon Gas Works; W. H. Smith, Bedford Gas Works; F. Linging, Norwich Gas Works; J. T. Browning, Colchester Gas Works; S. B. Darwin, Portsmouth Gas Works; J. McCrae, Dundee Gas Works; W. J. Wells, Stamford Gas Works; J. M. Darwin, Longton Gas Works; J. Paterson, Warrington Gas Works; and J. Coulter, of the Dundalk Gas Works. All of the foregoing gas works are located in Great Britain.

Mr. Charles A. Gerdenier, Superintendent of the Bridgeport (Conn.) Gas Light Company, writes as follows, under date of Dec. 3, 1887:

"The C. & W. Walker Tar and Carbonic Acid Extractor has been in operation at these works for the past six weeks, and is an unqualified success. It removes every particle of Tar from the gas in once passing through the apparatus, and a large percentage of the Carbonic Acid. I also feel quite sure that it prevents the formation and deposit of Naphthaline, because since I started the Washer I have had no stoppages from this cause. These works have been seriously troubled with Tar for many years, and I have used several kinds of apparatus and every expedient which has come to my attention for dealing with the difficulty, but without success. The Walker apparatus occupies comparatively small space, is less expensive than other systems, and requires but little attention. I carry 2¼-inch seal, and have an automatic tar delivery valve. This Tar Extractor is indispensable to gas makers."

I have taken the Agency for the United States for this apparatus, and am now prepared to make contracts to erect it on the premises of any Gas Company. It would be manufactured in the following sizes:

No. 1,	50,000	to	100,000	cu.	ft.	per	24	hrs.,	3	ft.	square,	5 ft. deep.
No. 2,	"	"	125,000	"	"	"	4	"	"	"	"	
No. 3,	"	"	250,000	"	"	"	5	"	"	"	"	
No. 4,	"	"	500,000	"	"	"	6	"	"	"	"	
No. 5,	"	"	750,000	"	"	"	7	"	"	"	"	
No. 6,	"	"	1,000,000	"	"	"	8	"	"	"	"	
No. 7,	"	"	1,250,000	"	"	"	9	"	"	"	"	
No. 8,	"	"	1,500,000	"	"	"	10	"	"	"	"	
No. 9,	"	"	2,000,000	"	"	"	12	"	"	"	"	
No. 10,	"	"	3,000,000	"	"	"	15	"	"	"	"	

This Tar Extractor will perform its work with about one-fourth the usual back-pressure heretofore required. It is simple in construction, and can be supplied at a very reasonable price—less than any other ever before introduced. Satisfactory results will be guaranteed in every instance.

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Elkhart Gas L.t & Coke Co.	Elkhart, Ind.
Madison City Gas Light Co.	Madison, Wis.
South Bend Gas Light Co.	South Bend, Ind.
Sheboygan National Gas Co.	Sheboygan, Wis.
Salina Gas Light Co.	Salina, Kansas.
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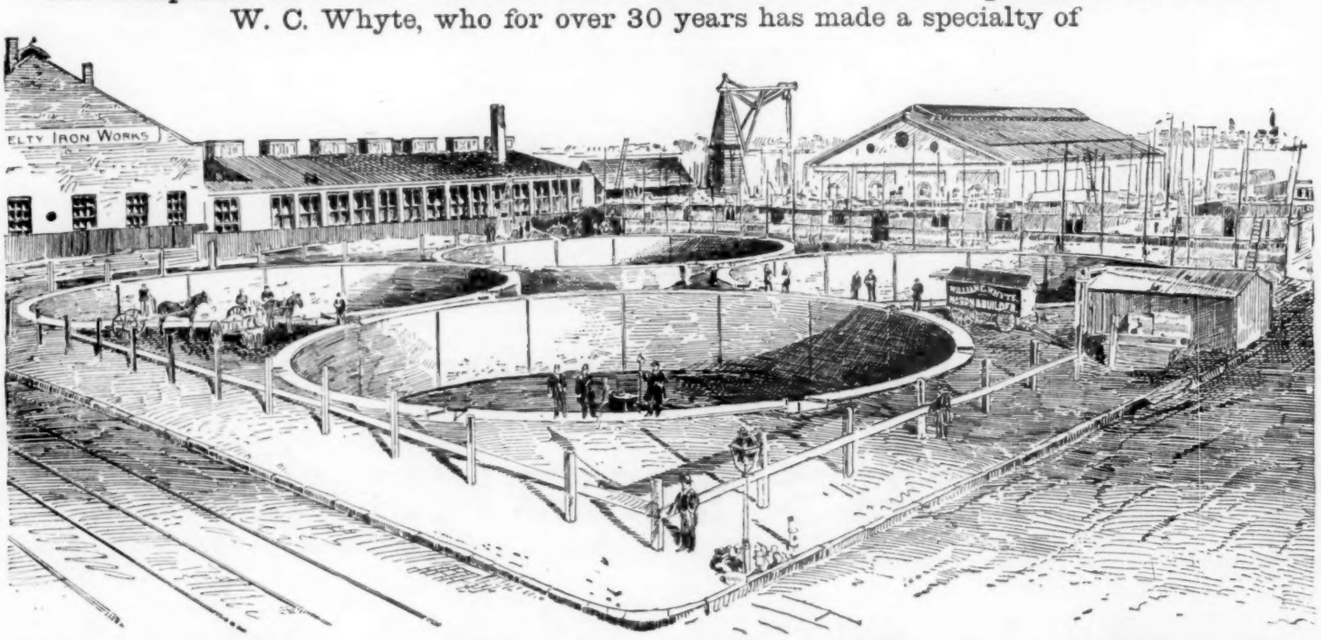

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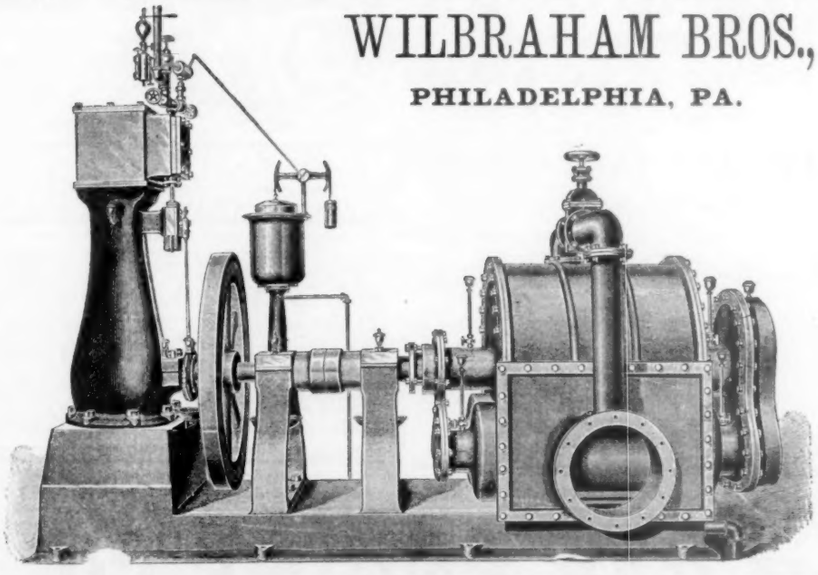

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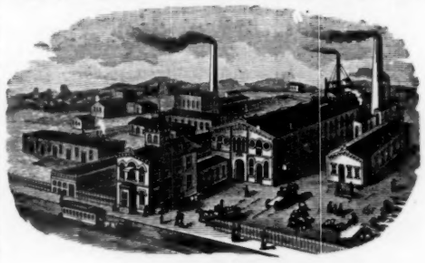

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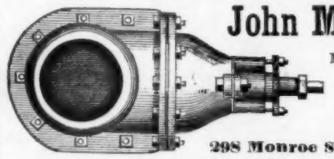

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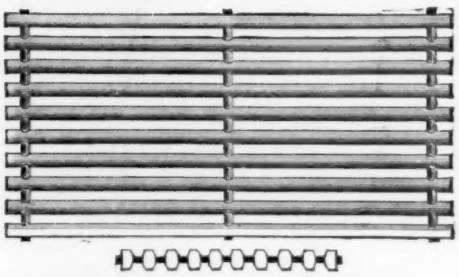

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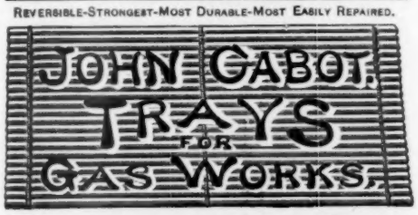

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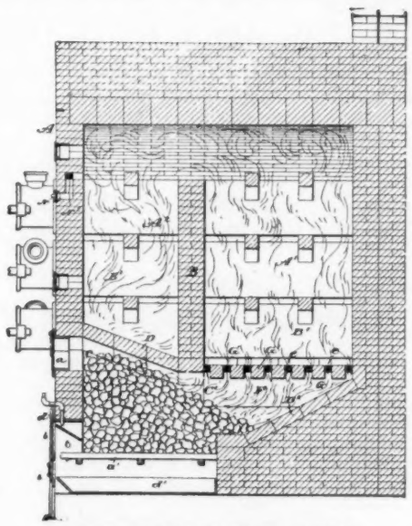

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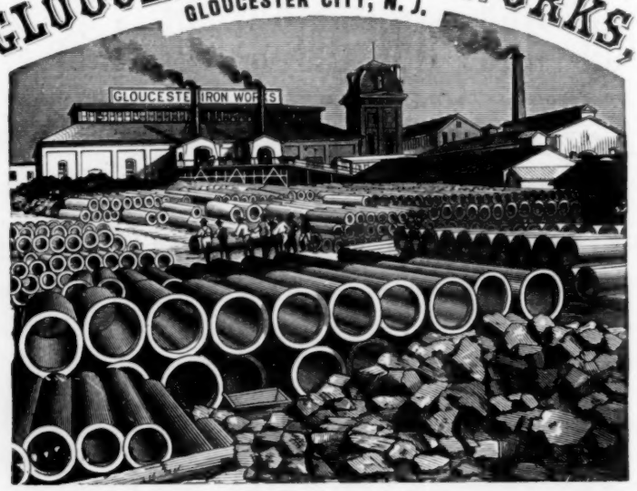

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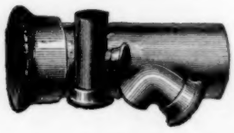

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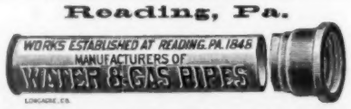

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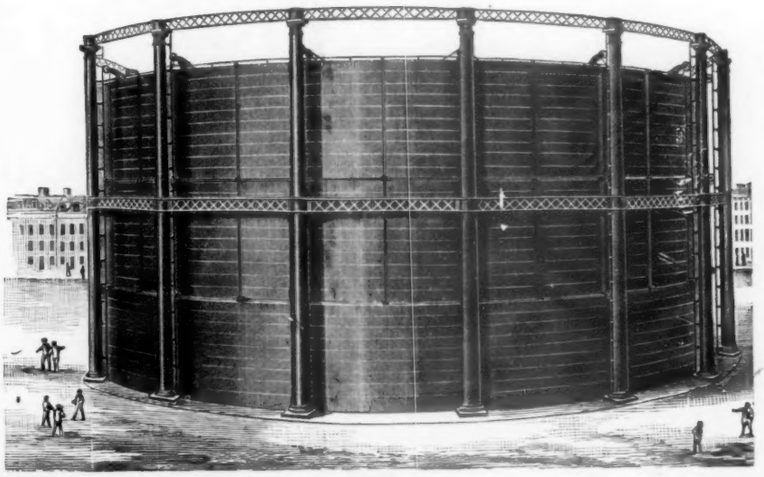

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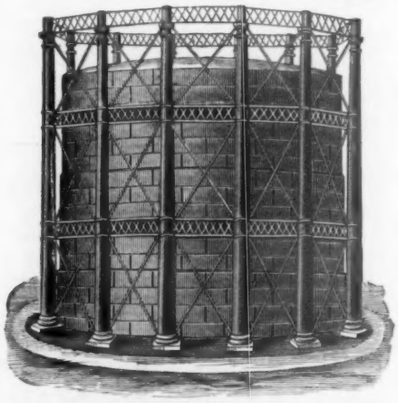

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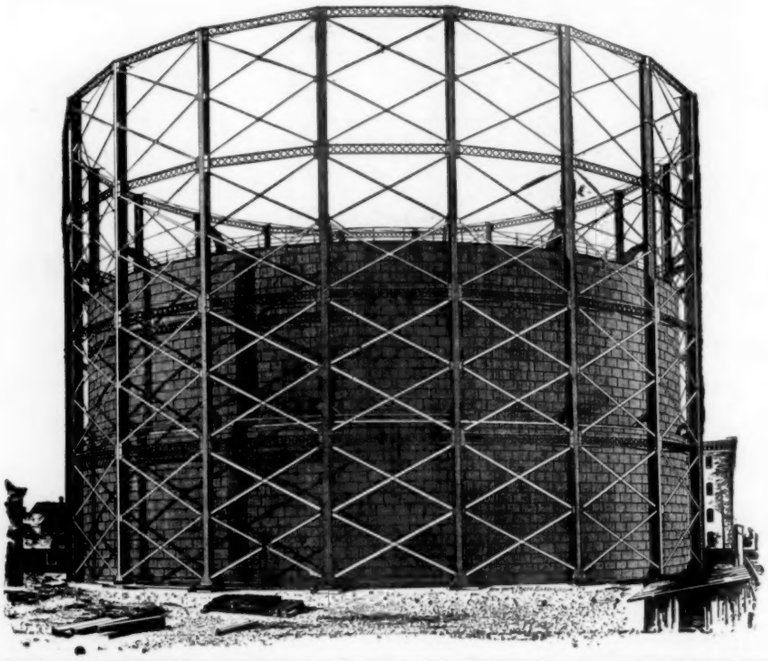

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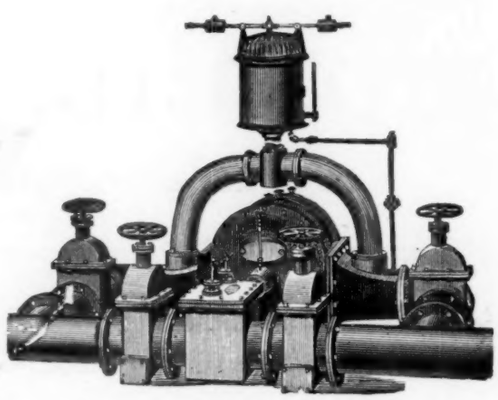

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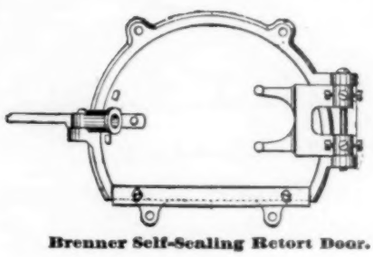

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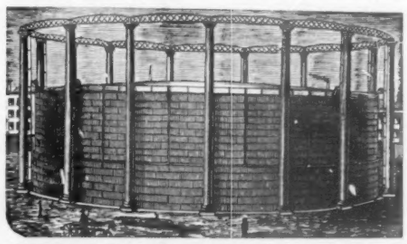
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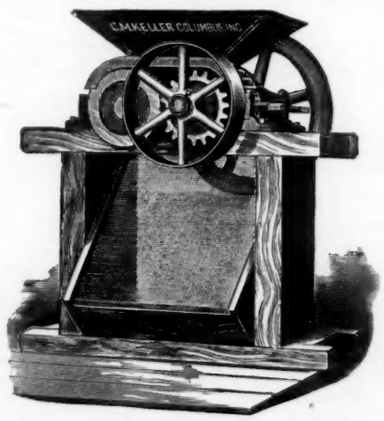

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GAS COOKING STOVE, No. 8 C.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
37 in. high.	12 in. high.	12 in. high.	24 in. long.	36 in.
20 in. wide.	17½ in. wide.	18 in. wide.	21 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has four burners on top, and double oven burner.

Consumption of gas with all burners in use, 42 feet per hour, at 1 inch pressure.

The top is made in sections, so that a greater variety of cooking utensils may be used. By lifting out the covers and crosspieces and putting in a suitable forked ring, which is sent with each stove, a wash boiler or other large utensil may be set over two burners. Our **No. 87 GRIDDLE** also fits in the same position. The roasting oven is provided with a cast-iron door.

All Fittings are Nickel-Plated.

GAS COOKING STOVE, No. 7 B.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
31 in. high.	9½ in. high.	10 in. high.	21 in. long.	32 in.
17 in. wide.	14½ in. wide.	15 in. wide.	16 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has three boiling burners in the Top or Hot Plate, and one single oven burner.

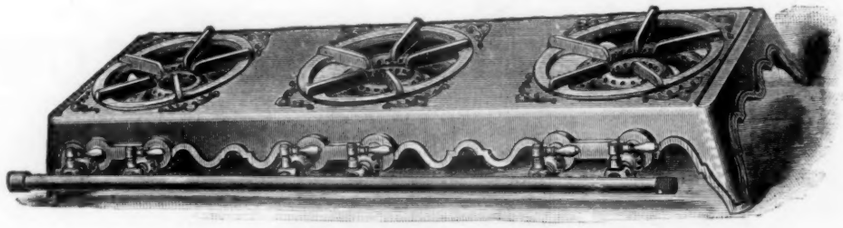
This cut represents our New Style Cooking Stove. As will be seen, it has an ornamented cast-iron Base and Front, and extension shelves. The Oven Burner, which is atmospheric (unless otherwise ordered), is of an entirely new and improved pattern (patent). The ovens are of greater capacity than those of the old style. The Top, in conjunction with the Outlet Pipe, is designed to carry off all the products of combustion, if desired, but they are also supplied with a loose ring which converts it into an ordinary open top stove.

The consumption of this Stove is 35 cubic feet per hour at 1 inch pressure, with all Burners in use.

All Fittings are Nickel-Plated.

"RADIANT" BOILING STOVE, WITH REGENERATIVE BURNER.

Size, 6½ inches diameter, 3 inches high. Consumption, 6 feet per hour at 1 in. pressure.



HOT PLATE, No. 111.

Size, 36 in. long, 12 in. wide, with three double burners, 6 taps.

Consumption, with all burners in use, 36 cubic feet per hour, with 1 in. pressure.

½ in. supply pipe should be used where the pressure is 1 in. or over.